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Agriculture and Industrialization

*The Adjustments That Take Place as an
Agricultural Country Is Industrialized*

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To the memory of
MY FATHER AND MOTHER

PREFACE

THIS STUDY was begun nearly ten years ago as a phase of a research project in the economics of the agriculture of China, for the Institute of Social Sciences, Academie Sinica. Subsequent developments in China growing out of the last Sino-Japanese war brought to the fore the whole problem of China's industrialization, and the form of such industrialization in agricultural countries like China. My later studies at Harvard University convinced me that the process of industrialization of an agricultural country needed to be examined as a world problem. None of the literature which I presently explored dealt at all systematically with this subject. This book is a serious attempt to do so. It does not claim, however, to cover all phases of the subject.

Particular mention perhaps should be made of the limited discussion of the part played by the handicrafts and the so-called "rural industries" in the industrialization process. The impacts of industrialization upon these as well as their position in the transition period are significant enough to justify specific attention. Limits of time forced me to reserve treatment of this part of the subject until later.

I wish to express my great indebtedness to the professors at Harvard University under whom I worked as a graduate student, and particularly to John D. Black, Henry Lee Professor of Economics, under whose immediate direction this book was written, and to Professor Abbott P. Usher, whose thinking on problems of industrialization and location theory was of great assistance. Appreciation must also be expressed of the help of Miss Althea MacDonald, secretary of the Committee on Research in the Social Sciences of Harvard University, in preparing the manuscript of this book for the press, and to the editorial staff of the Harvard University Press.

PEI-KANG CHANG

Wuchang, China
September 1947

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on the countries already highly industrialized? To answer these questions requires a study of trade and capital movement between agricultural and industrial countries.

4. Keeping in mind all the implications and complications raised above, what are the particularly pressing problems which would most probably confront an agricultural country during its process of industrialization? Study of these problems should command immediate and profound interest. This book can of course make only a preliminary analysis of them.

This study was undertaken because of its high pertinence in China, which is at the stage in its history where the industrialization process seems likely to accelerate in the next few decades, but it deals with its subject in terms that apply to any agricultural country in the process of industrialization.

CHAPTER I

BASIC CONCEPTS

THIS OPENING CHAPTER will attempt to define the use of certain terms and state the underlying concepts upon which this study is based.

First of all, when we speak of industry we mean manufacturing, as distinguished from agriculture and from trade and transportation. Sometimes, however, the reader no doubt is aware, the term is also applied to all economic activity; for example, Black's classification of all industries into the three following groups:¹ (1) the extractive industries, including mining, lumbering, fishing, hunting, and water-power utilization; (2) the genetic industries, including agriculture, forestry, and fish culture; and (3) manufacturing and mechanical industries, including construction and the hand trades. These industries are called primary production, to be distinguished from transportation, storage, merchandising, banking, and professional services. Again, Colin Clark uses the term industry to include even those production lines which supply only services, and also classifies all industries into three different groups:² (1) primary industries, including agriculture, forestry, and fishing; (2) secondary industries, including manufacturing, mining, and building; (3) tertiary industries, including commerce, transport, services, and other economic activities. It is evident that Black's primary production includes both the primary and secondary industries of Clark's classification. Finally, Leontief uses the term *industry* in a still broader sense in his empirical application of the general equilibrium analysis to the study of the struc-

¹ John D. Black, *Introduction to Production Economics* (New York, 1926), pp. 66-86.

² Colin Clark, *Conditions of Economic Progress* (London, 1940), p. 182.

ture of the American economy. Besides all the industries mentioned above, he treats "households" as an industry.³

It is well for the reader to keep these broader uses of *industry* in mind, because they will be found in some of the literature upon which this study is based; but in these pages the term *industry* will be used only in the narrow sense first named.

There will be occasion to speak from time to time of *an industry* — perhaps, for example, of a textile industry or a milling industry. This is entirely in keeping with established practice, and ordinarily introduces no confusion. It has sometimes bothered the students of imperfect or monopolistic competition to determine the boundaries of such an industry — for example, where the textile industry ends and the clothing industry begins; but these difficulties are of little concern for this study. We shall have in mind, in speaking of a particular industry, simply the group of similar products that are more directly in competition with each other than they are with any other products.⁴

In this study, the term *agriculture* will be used to include all types of farm enterprises. Farm enterprises are linked together by a common feature: a close technical relationship with *land*. In this respect, both forestry and mining are very much like agriculture. But agriculture differs from mining in that it is a *genetic* undertaking whereas the latter is an extractive one. Forestry, except in new countries, is also a genetic enterprise and is very difficult to distinguish from agriculture except by a common-sense and conventional standard.⁵

Since this study deals primarily with the relations between agriculture as thus defined and industry defined as manufacturing, our analysis unavoidably involves the basic conceptions of general and partial equilibrium, and it is to these concepts and

³ Leontief classifies all industries (actually all economic activities) into ten groups, namely: agriculture and foods, minerals, metals and their products, fuel and power, textile and leather, steam railroads, international trade, Industries Not Otherwise Specified, undistributed (mainly trade services and professional services), households. See Wassily W. Leontief, *The Structure of the American Economy, 1919-1929* (Cambridge, Mass., 1941), pp. 69-72.

⁴ For a detailed discussion on the concept of *an industry*, see Appendix A.

⁵ For further explanation of the term *agriculture* and the place of agriculture in relation to industry, see Appendix B.

those of the location theory that the remainder of this chapter will be devoted.

A. GENERAL EQUILIBRIUM APPROACH

The general equilibrium approach provides no place for *an industry*. It is based on the equilibrium of firms and of households, and from these it leads directly to general equilibrium in the economy.⁶ In the state of general equilibrium it implies that every household and every firm in the domain is, taken by itself, in equilibrium. For the households this means that, under the existing circumstances, tastes and economic horizon included, no household feels able to improve its situation by transferring any element of its money income from the commodity on which it is actually spent to any other commodity. For the firms this means that, under existing circumstances, technological and commercial knowledge and economic horizon included, no firm feels able to increase its revenue by transferring any element of its monetary resources ("capital") from the factor on which it is actually spent to any other factor. Prices and quantities must also fulfill the following conditions if Walrasian equilibrium is to prevail. Every household's and every firm's budget must exactly balance. All quantities of all commodities produced by firms must be bought by households or other firms. All existing factors must be used to the extent that their owners wish to see them used at the prices they can get, and no demand, effective at those prices, must go unsatisfied.⁷ The general equilibrium approach assumes "perfect competition," and in the theory of production it assumes "fixed" technological coefficients of production. Their analysis is entirely "static."

From the general equilibrium approach, analysis of the interdependence of any two industries or two groups of industries

⁶ For study of the general equilibrium theory, besides Walras' *Elements d'économie politique pure* (Lausanne, 1926), the following works are to be recommended: J. R. Hicks, "Leon Walras," *Econometrica*, II (October 1934) 338-348; Joseph A. Schumpeter, *Business Cycles* (New York and London, 1939), I, 38-45; Robert Triffin, *Monopolistic Competition and General Equilibrium Theory* (Cambridge, Mass., 1940); George J. Stigler, *Production and Distribution Theories* (New York, 1941), Chapter 9 "Leon Walras," pp. 228-260.

⁷ Schumpeter, *Business Cycles*, pp. 42-45.

is not only impossible, but also unnecessary. It is impossible because a logical concept of an industry which conforms to both theoretical perfection and practical reality cannot be obtained. It is unnecessary because this approach emphasizes only general interdependence rather than partial interdependence. Therefore, from this approach, we are permitted to say at most that the interdependence of agriculture and industry is only "merged" into the general economic interdependence. But we must recognize that there is no way whatsoever to separate this particular interdependence (of agriculture and industry) from the general interdependence, if we are to conform to the rigid theoretical standard of this approach.

It has been generally agreed that emphasis on the general interdependence of economic phenomena is a great contribution that the general equilibrium approach has made to economic analysis. Yet the assumption of fixed coefficients of production has nullified its applicability to any historical study. This assumption, together with that of perfect competition and the giving up of the concept of industry, has made its theory even less realistic, and hence made its theoretical scheme unsuitable even for the short-run empirical studies.

In this connection, Leontief's ingenious yet bold attempt to apply the general equilibrium analysis to the study of a real economic structure should be mentioned. In *The Structure of American Economy*,⁸ as briefly mentioned in the section above, he relaxes the rigidity of the theoretical concept of industry by adopting a realistic and common-sense one and upon that basis classifies industries (and households) into ten groups. His justification is that factor substitution between large industrial groups is limited. This may be accepted. But he still maintains the assumption of fixed coefficients of production. He assumes that changes in productivity affect all factors employed by an industry "in equal proportions." He also assumes, in the field of consumption, a "proportionate" adjustment of expenditure to a rise in real income. All these assumptions would limit greatly the applicability of the results thus obtained, although it should

⁸ Leontief, *The Structure of American Economy*, 1919-1929.

be admitted that the attempt is highly encouraging and the work has already made a great contribution.

Leontief's method may be suggestive if we want only to study the interdependence of agriculture and industry in a stationary state. Of course, from the general equilibrium approach, it is impossible to separate this particular interdependence from the general one. What can be done in order to follow his treatment is to relax by one more step the rigidity of the theoretical concept of industry. Thus, in a rough way, all firms may be divided into three groups: agriculture, industry, and service (including transport, trade, banking, and professional service.) Together with households, there are then four groups. Therefrom it is possible to follow Leontief's theoretical scheme and use his three sets of equations. The effects of any change in one group (factor or factors of production in one group) upon the other groups or upon the whole economy may be studied. Because the number of industries has been reduced from ten to four, the relationship between agriculture and industry can be seen more clearly. Such an attempt is quite admissible.

B. PARTIAL EQUILIBRIUM APPROACH

The partial equilibrium approach (or the Marshallian type of analysis) differs from the general equilibrium approach (or the Walrasian type of analysis) in that, for a given instant (or period) of time, it confines itself to the study of one phenomenon, or the relationship between two phenomena, while it assumes that other phenomena remain constant, using the famous phrase of "other things being equal." The merits and demerits of the approach in question have constituted for a long time a topic of controversy of which the present essay, in consideration of its limited space, will give no detailed discussions. What concerns us most essentially at the present is that the partial equilibrium approach has centered on the equilibrium of an industry only, with no attention, at least no systemic discussions, devoted to the equilibrium either of a firm or of a general economy. The basic concept upon which this is founded may be stated as follows: "If general equilibrium prevails, every firm and every industry is individually in equilibrium; but an individual firm

or an individual industry may be in equilibrium while there is no general equilibrium. And for some purposes, an individual industry may be said to be in a state of equilibrium while the firms composing it are not.”⁹ Such a concept is logically quite well founded, although it may not be borne out by the realities of economic society. If such is the case, it would be due not so much to the untenability of the concept itself as due to the unreality of the equilibrium concept as a whole. Limitations of this sort have to be faced by any equilibrium approach.

The partial equilibrium approach is more appropriate to the present study than the general equilibrium approach for several reasons. First, the present study centers on the interdependence and the changing relations between two broad industries: agriculture, and industry in the narrow sense. In this respect, the partial equilibrium approach, which in the main also centers on the study of an industry, would fit our purpose very well, although subject to many modifications. Moreover, there are so many economic activities as to make it impossible to study all activities at one time. For the sake of simplicity,¹⁰ a method must be adopted under which only two kinds or groups of economic activities are considered, while assuming others constant or changing in a uniform degree. Finally, the present study is intended as a dynamic as well as an evolutionary type of analysis. But

the general, and at the same time dynamic, type of analysis still remains an unwritten chapter of economic theory, the claims of innumerable “model-builders” notwithstanding. Since the successful explanation of the famous hog cycle, the partial but dynamic scheme seems to dominate the field of applied economic theory.¹¹

⁹ Schumpeter, *Business Cycles*, I, 43.

¹⁰ This type of simplicity is to be distinguished from that of “analytical” simplicity for a theory which requires fewer assumptions and hence is more general in its applicability. See George J. Stigler, *The Theory of Competitive Prices* (New York and London, 1942), p. 8; Morris R. Cohen and Ernest Nagel, *An Introduction to Logic and Scientific Method* (New York, 1934), pp. 213–215.

¹¹ Leontief, *The Structure of American Economy*, p. 33.

It is because, in the present state of methodological availability, only the partial approach permits us to use the dynamic and evolutionary analysis at the same time, that we have to give up the general equilibrium approach, although with reluctance.

It is not too sweeping to say that all historical studies and some statistical or descriptive studies about agriculture or about a single industry are those of partial analysis. But it is unfortunate that there has been no single book or even article, to the present knowledge of the writer, which discusses in a systemic way, either theoretically or historically or statistically, the dynamic and evolutionary relationship between agriculture and industry, as well as between agricultural improvement and industrial development. Save in a few famous works, which have recognized the importance of the problem and discussed it briefly,¹² most studies about general economic history have paid no attention to the problem.

In accordance with the partial analysis, the study of the interdependence of agriculture and industry may be undertaken in this way. First, a given population, taste, and technology are assumed. Under these assumptions, together with the assumption that economic activities of other fields remain unchanged, the "static" interdependence of agriculture and industry is analyzed. Under the same set of assumptions, we may proceed, following the theoretical pattern of the hog cycle or Cobweb Theorem, to analyze the "dynamic" interdependence of the two fields in question. Next, changes in population, in taste,

¹² For example, Paul Mantoux, in his famous book *The Industrial Revolution in the Eighteenth Century* (New York, 1928), has an inspiring chapter discussing the changes which occurred in the use of land during the period of industrial revolution. Especially at the end of the chapter, he devotes several paragraphs to a brief discussion of the relation between the transformation of agriculture and that of industry. See Chapter 3, "The Redistribution of the Land," pp. 140-190.

A. P. Usher emphasizes the social aspect of the problem in *The Industrial History of England* (New York, 1920), p. 365, and later analyzes, though also very briefly, the historical changes of the interdependence of industry and agriculture in a book of which he is one of the authors. See W. Bowden, M. Karpovich, and A. P. Usher, *An Economic History of Europe Since 1750* (New York, 1937), pp. 4-5.

and in technology are introduced. These changes are introduced in turn in each of the three while holding the other two constant or, in some cases, changing them in a uniformly progressive degree. The economic activities of fields other than agriculture and industry may be treated in the same way. Then it is possible to see and analyze what the relationship would be theoretically, and what it has been historically, between agricultural improvement and industrial development during the period of the so-called Industrial Revolution.

To do this, the partial analysis of the traditional Marshallian type would not be sufficient. Some modifications, among which the most important are the theory of imperfect competition and the aggregative approach, are to be mentioned and, if useful for our purposes, to be applied. Some additional ideas, such as the location theory, will also be discussed and, in due course, employed.

The theory of imperfect or monopolistic competition¹³ modifies the classical theories in two ways. First, it introduces the theory of the firm in addition to that of the group or the industry, which has constituted the main skeleton of the Marshallian analysis. In this respect, it differs also from the Walrasian analysis, where the concept of group is entirely discarded. In the second place, the theory replaces the assumption of perfect or pure competition by one of imperfect or monopolistic competition. This is as clear as the term would indicate.¹⁴ While perfect competition may serve as an ideal case in which the equilibrium analysis is especially useful, the theory of imperfect competition is justified in claiming to be more realistic and under its analysis the perfect competition would be treated as a special case.

¹³ The standard works about the theory are E. H. Chamberlin's *Theory of Monopolistic Competition* (Cambridge, Mass., 1933), and Joan Robinson's *Economics of Imperfect Competition* (London, 1933). Another important book that should also be mentioned is F. Zeuthen's *Problems of Monopoly and Economic Warfare* (London, 1930).

¹⁴ The terms, however, are not so clear as they sound. Differences between the term "imperfect" and the term "monopolistic" are time and again emphasized by Chamberlin. See his article, "Monopolistic or Imperfect Competition?" *Quarterly Journal of Economics*, August 1937. The present writer uses the two terms interchangeably, because for the moment their dissimilarities are assumed to be negligible.

But it is to be pointed out that under imperfect and monopolistic competition the use of equilibrium analysis is greatly limited. Because of the genetic characteristics, it is impossible to have a stable equilibrium either for a firm or for a group (industry).¹⁵ In spite of these limitations, the theory of imperfect competition would still find valuable application to the present study.

It is generally assumed by most economists, even today, that perfect competition exists in agriculture while imperfect or monopolistic competition exists only in industry. This assertion is, however, not borne out by the fact. We admit that the farm as an economic unit is really so small relative to the market that it exerts no perceptible influence on the prices of the commodities it buys and sells. This may fulfill one of the conditions of perfect competition. But other conditions of perfect competition are in no sense more satisfactorily met by agriculture than by industry. All agricultural or rural markets are in no way free from special institutional restraints, nor from geographical and physical hindrances. In other words, prices and the mobility of resources are far from being unrestricted. Furthermore, the farm or rural family as an economic unit does not possess complete knowledge, and is, in most cases, much less favorably informed of the market news than the economic units in an urban area. The market form that we really have in a rural community is usually either a "monopsony" or an "oligopsony."¹⁶ As to the production structure, it is nothing new to say that response of farmers or farms to changes in prices is very slow and in some cases even nil.

Any analysis, either purely theoretical or historical, of the functional relationship between agriculture and industry requires an application of the theory of imperfect competition if the results are to be in accord with what has happened in the economic society and what would most likely happen under

¹⁵ See especially N. Kaldor, "The Equilibrium of the Firm," *Economic Journal*, March 1934, pp. 73-74; W. F. Stolper, "The Possibility of Equilibrium Under Monopolistic Competition," *Quarterly Journal of Economics*, May 1940.

¹⁶ An interesting analysis of the problem, though confined only to agricultural industries, has been made by William H. Nicholls, *A Theoretical Analysis of Imperfect Competition with Special Application to the Agricultural Industries* (Ames, Iowa, 1941).

the present economic system. For example, when farmers sell their farm products to an industrialist for use as raw materials, the situation would not be satisfactorily explained by perfect competition alone. The same would be true not only when farmers buy farm machinery or fertilizers from an industrialist, but also when they buy, as pure consumers, clothes and other goods for household purposes. In a village community where no contact was made with the outside and exchange occurred only among the people who constituted the society, it may be said that some form of perfect competition might have existed. As soon as farmers are bound to sell farm products to, and buy industrial goods from, those specialized merchants and industrialists who have long enjoyed the privilege of monopoly, the theory of imperfect or monopolistic competition would better apply. A reference to any historical fact, even of the medieval age, would approve this statement.

Whoever works with partial equilibriums soon also realizes the necessity of an instrument which will enable him to handle processes going on in the system as a whole which escape his "partial" tools. He is then likely, especially if trained in the Marshallian traditions, to complement his equipment by a system of relations between social aggregates (such as total output, total income, net total of profits), and to consider these together with the elements of outstanding importance for the system as a whole (such as quantity of money, rate of interest, and price level). If these elements are so adjusted that there is no tendency to change arising from their relations to each other, one may speak of "aggregative equilibrium" and formulate certain propositions about it. This is the equilibrium concept used, for example, in Keynes' *Treatise on Money*.¹⁷ Its usefulness for some purposes cannot be denied. But it is obvious that

this kind of equilibrium is compatible with most violent disequilibria in every other sense. And these disequilibria will assert themselves by changing the given situation, including the aggregative quantities themselves. It is, therefore, misleading to reason on aggregative equilibrium as if it displayed the factors which initiate change and as if

¹⁷ J. M. Keynes, *Treatise on Money* (New York, 1930), vol. I.

disturbance in the economic system as a whole could arise only from those aggregates.¹⁸

The limitations of the aggregative equilibrium approach as applied to the present study would be greater than has been stated by Schumpeter in dealing with business cycles as quoted in the above paragraph. This is because any dealing with the characteristics of an industry or the relations between two industries would lose its significance in dealing only with total output and total income and their relations to quantity of money, rate of interest, and price level. The latter would in general give us no information about the former. Nevertheless, the usefulness of the aggregative approach even for the present study is not to be entirely denied. First, so far as economic goods are concerned, agriculture and industry cover the larger part in a given economic society. Thus the total output may be indicative, though not representative, of the production of both agriculture and industry. Given a proportion of national income for agriculture and industry respectively, we may be able to study, for example, the effects of the rate of interest or of the price level on the production of either of them. In this respect, the aggregative approach is indirectly helpful. Second, in studying the speed of industrialization, we must rely in one way or another on the analysis of total output and total income. From that, we may use the above method to break the totals down into the two production fields in question. Finally, in a comparative study of two economic societies, such as of two countries, the aggregative approach is especially useful because it would clear the ground for any partial analysis.

C. APPROACH FROM THE LOCATION THEORY

The pioneering works on the theory of location are those of J. H. von Thünen on the location of agriculture¹⁹ and of Alfred Weber on the location of manufacturing industries.²⁰ Since then,

¹⁸ Schumpeter, *Business Cycles*, I, 43.

¹⁹ J. H. von Thünen, *Der isolierte Staat in Beziehung auf Landwirtschaft und Nationalökonomie*, 1st edition (Berlin, 1826).

²⁰ Alfred Weber, *Über den Standort der Industrien*, Teill, "Reine Theorie des

some contributions have been added to the theory either by illustrating it,²¹ or by elaborating upon it and applying it to a realistic society,²² or by making a purely theoretical analysis.²³ However, it is only since the studies of W. H. Dean, Jr. and A. P. Usher that a further extension and deepening of the theory has been made.²⁴ It may be taken as a new start. This new approach differs from the old ones in several respects. First, it refers to economic activity of all kinds and is not confined to agriculture or industry alone. Second, it is not purely static, but also, and particularly, dynamic. It is dynamic in the sense that historical changes are involved. Finally, the new approach does in no way rely on mathematical treatment. This is because the mathematical treatment would have to be based on the assumption that economic activity takes place upon a completely undifferentiated plane surface, which, by no means, fits the reality. The central thesis of the new approach may be stated thus:²⁵

1. It is desirable to direct our interest in the first instance towards the broader aspect of the developing patterns of population density.
2. It is desirable to study the relations of these patterns to localized resources and to the significance that regional resources possess under the technological conditions of each historical period.
3. It is necessary also to recognize explicitly the significance of accessibility of resource deposits to long-distance trade.
4. The study of differences in accessibility requires careful analysis of the topography of the primary regions of the world.

Standorts," 1st edition (1909), and "Industrielle Standortslehre," in *Grundriss der Sozialökonomik*, 1st edition (1914), Vol. VI. The former has been translated into English by C. J. Friedrich as *Theory of the Location of the Industries* (Chicago, 1929).

²¹ Such as: A. Predohl, "The Theory of Location in Its Relation to General Economics," *Journal of Political Economy*, Volume 36 (1928), pp. 371-390.

²² Such as: E. M. Hoover, *Location Theory and the Shoe and Leather Industries* (Cambridge, Mass., 1937).

²³ Such as: H. Hotelling, "Stability in Competition," *Economic Journal*, March, 1929.

²⁴ W. H. Dean, Jr., *The Theory of the Geographic Location of Economic Activities* (selections from the author's thesis submitted for his doctorate at Harvard University), published as a pamphlet (Ann Arbor, Mich., 1938); A. P. Usher, *A Dynamic Analysis of the Location of Economic Activity* (Mimeographed, 1943).

²⁵ Usher, *Dynamic Analysis*, p. 4.

The usefulness of the location theory for our present study lies not only in that it brings into the picture the locational aspect of the problem, but also in that, as has been undertaken by the dynamic approach of the theory, it points out the changes of the basic locational factor from one historical period to another, and upon this factor other economic activities are to be focused. For example, the new approach has found that, from the eighteenth century down to the present century, a change from locational patterns dominated by food to locational patterns dominated by coal has taken place, and that change has been brought about by the generalized application of power to industry.²⁶ Such an analysis would be of great service to our study because it singles out one of the basic changes that have occurred in some highly industrialized countries since the industrial revolution began. Even the old location theory is not entirely run out of service. Von Thünen's "Zones of Production" and his study of the influence of transportation upon the localization of agricultural production is still valuable and, with due qualifications, applicable to modern society. As Black has well said, "modern city market areas represent simply in exaggerated form the same effect as the river in von Thünen's illustration."²⁷ The most important contribution of Alfred Weber lies in undertaking a schematic analysis of the distribution of processing activities when orientated primarily with reference to transport costs. His theory has the merit of concentrating attention upon the "real cost" items in location. The assumption of constant costs would of course limit greatly the applicability of his theory. Nevertheless, it may still be permissible to take his theory as a beginning step for the study of industrial location, if analysis of a single industry is necessary.

With the new approach of the location theory — or it may be called "the general and dynamic location theory" — there is intrinsically no need for making a distinction between agricultural and industrial location. The new approach emphasizes in general the population settlement, utilization (and limitation) of resources, and the working relationship of the two. Relations of

²⁶ Bowden, Karpovich, and Usher, pp. 4-13.

²⁷ Black, *Production Economics*, p. 193.

agriculture to industry during the process of industrialization, therefore, can be explained by that approach only in general terms, but not in specific details. The old location theory, on the other hand, applies to a specific industry — such as von Thünen's on agriculture and Weber's on manufacturing in general. But both of the latter are static analyses and cannot be used to explain the dynamic relations of agriculture to industry during the period of industrial revolution. All these limitations point to the inevitable fact that approach from the location theory alone would be inadequate for this study.

FINAL REMARKS ON ANALYTICAL METHODS

From the above discussions, it can be seen that none of the methods available at the present stage, if used alone, will provide tools to meet sufficiently the need of the present study. First of all, it may be questioned whether the equilibrium concept can be applied at all to an evolutionary process like industrialization. Even assuming that the concept of moving equilibrium or the concept of the central tendency toward equilibrium may be accepted, the technological changes which affect the economic process qualitatively can in no way be given sufficient treatment under any equilibrium method.

The general equilibrium approach has the merits of recognizing and emphasizing the general interdependence of all economic activities — agricultural and industrial, as well as many others. It prevents us from drawing hazardous generalizations upon a set of particular events or behaviors. But the method is insufficient for this analysis for the reasons that, first, only two groups of economic activities are to be emphasized — agriculture and industry — and, second, the static assumptions used in that method limit its applicability to our evolutionary process.

The particular equilibrium approach will fit our purposes more adequately than other kinds, if duly modified and used in collaboration with other methods. It is to be pointed out that this method must be employed with caution. There are very real dangers of overmuch sectionalism in economic studies. In recent years there has been an immense extension of sectional

studies in the economic field. As Lionel Robbins has brilliantly remarked

in the realm of Applied Economics, some division of labour is essential, and theory cannot be fruitfully applied to the interpretation of concrete situations unless it is informed continually of the changing background of the facts of particular industries. But, as experience shows, sectional investigations conducted in isolation are exposed to very grave dangers. If continual vigilance is not exercised they tend to the gradual replacement of economic by technological interests. The focus of attention becomes shifted, and a body of generalizations which have only technical significance comes to masquerade as Economics. And this is fatal. For, since the scarcity of means is relative to "all" ends, it follows that an adequate view of the influences governing social relationships in their economic aspects can only be obtained by viewing the economic system as a whole. In the economic system, "industries" do not live to themselves. The *raison d'être*, indeed, is the existence of other industries, and their fortunes can only be understood in relation to the whole network of economic relationships. It follows, therefore, that studies which are exclusively devoted to one industry or occupation are continually exposed to the danger of losing touch with the essentials. Their attention may be supposed to be directed to the study of prices and costs, but they tend continually to degenerate either into mere accountancy or into amateur technology. The existence of this danger is no ground for dispensing with this kind of investigation. But it is fundamental that its existence should be clearly recognised. Here, as elsewhere, it is the preservation of a proper balance which is important.²⁸

Considering the danger of over-sectionalism and other limitations, the following modifications and additions to the particular equilibrium approach make it more satisfactory. First, when the adjustments between agriculture and industry as well as the relationships between agricultural reform and industrial development are analyzed, it is important not to lose sight of other economic activities and to keep in mind the concept and the fact of general interdependence in order to view the economic system as a whole. Secondly, the price and production

²⁸ Lionel Robbins, *An Essay on the Nature and Significance of Economic Science* (London, 1935), p. 42, footnote 1.

theories modified and the "group" concept introduced by the two Cambridge writers under imperfect and monopolistic competition are to be in due time employed. Thirdly, the "total" concept in respect especially to income, output, population, and resources as advocated by the aggregative approach is also to be used in some cases. Finally, the location theory, especially the modern dynamic location theory, will be employed to analyze the process in which the basic factors are generating and shaping the changing patterns of all economic activities.

Even with these modifications and additions, our method of treatment which centers on the particular equilibrium approach will by no means serve our purposes adequately. There exists a wide gap between the availability of the analytical tools provided by economic theory and the nature of our study. As we have already pointed out, the present study is intended as a theoretical as well as an empirical and historical one. Therefore, the gap may be in a way well analogized with the gap between economic theory and economic history. The departure of history from theory and of theory from reality has gone further in recent decades. Many economists as well as economic historians have time and again made pleas for theory in economic history and for recognition of close relationships between these two fields, and urged close coöperation on both sides.²⁹ This has my

²⁹ William Cunningham emphasized long ago the need of the economic historian for theory, as he said: "Economic History is not so much the study of a special class of facts as the study of all the facts from a special point of view." See his *Growth of English Industry and Commerce*, vol. I (Cambridge, England, 1905), p. 8.

Later on, Eli F. Heckscher made a strong plea for theory in economic history, as he says: "It is therefore necessary to repudiate the idea of Economic Theory and Economic History as belonging to different stages of human development. They are both essential to an understanding of all periods of history, including the present one." Also: "No doubt the value of economic theory increases enormously when the work of historians is carried further than the stating of external facts; for its most important use refers to the 'choice' of facts and the 'explanation' of them." See his article, "A Plea for Theory in Economic History," *Economic History*, January, 1929, pp. 526, 529.

John H. Clapham, in an inaugural lecture, has elaborated on the relation of theory and history and on the place of the economic historian in relation to the economist. See his *The Study of Economic History* (Cambridge, England, 1929), pp. 32-40.

whole-hearted endorsement, but it should be recognized that there are some intrinsic and technical difficulties inherent in human sciences which prevent theory and history from going closely together. The economist wants to build economics as a science, and confines his attention and effort to attaining theoretical purity at the expense of the reality of his assumptions. On the other hand, the economic historian finds his time occupied mostly in collecting and checking and presenting facts, and not much time remains for explaining these facts and basing them upon some sort of theory. In spite of the urgency that theory and history should come together, the gap still remains wide and there is no sign that it will be narrowed.

In this connection, the effort of the dynamic location theorists is especially to be noted. Also at this juncture, two great economists whose emphasis on development and knowledge of economic history were unsurpassed by their contemporaries are to be mentioned. One is Alfred Marshall, and the other is F. W. Taussig. Marshall's writings mark, though only in part, his mastery of historical knowledge. Taussig draws not only upon economic history to enrich the content of the theory of international trade, but also fashions out of international trade-theory concepts a tool for the economic historian. That tool has been applied by C. W. Wright to the study of the economic development of the United States.³⁰ In his analysis of the main factors which underlie the transformation of American manufacturing, Wright stresses three sets as fundamental: (1) the

Werner Sombart has gone even further than other economic historians in emphasizing the importance of theory to the study of economic history. He says that "theoretical training alone makes the true historian. No theory—no history: Theory is the pre-requisite to any scientific writing of history." See his article, "Economic Theory and Economic History," *Economic History Review*, January 1929, p. 3.

Lionel Robbins has also devoted a section in his widely read book to discussing the relation between economic theory and economic history. As well put by him, "Economic Theory describes the forms, Economic History the substance." See his *Essay on . . . Economic Science*, p. 39; for a detailed discussion see pp. 38-42.

³⁰ Chester W. Wright, "The Fundamental Factors in the Development of American Manufacturing," in *Exploration of Economics* (New York and London, 1936), pp. 516-525.

comparative cost of the main factors of production; (2) transportation and related costs as limiting the area within which exchange based on differences in comparative costs could take place; (3) the group of artificial factors, based mainly on legislation, tending to restrict or to stimulate manufacturing development. The first two sets of factors are what the dynamic location theorists also emphasize. But the theory of comparative cost is obviously a tool fashioned by and borrowed from the classical international trade theory. How serviceable this approach is remains to be seen. The attempt should receive encouragement for, if successful, it will tend to narrow the gap between theory and history.

In this essay, study will be undertaken and carried on in the following way. In the first stage the interdependence of agriculture and industry under static assumptions will be analyzed.³¹ The static assumptions will indicate a given population, taste, and technology. Taste as a factor will, however, receive no analysis. To these assumptions, one more will be added — that economic activities of other fields remain unchanged. This is a well known phrase used by the particular equilibrium approach. It is to be emphasized that under this approach any conclusions must be carefully drawn so as not to lose sight of the presence of other economic activities outside the agricultural and industrial fields. Later on, we shall introduce the change of population but still assume no change in technology. This is the case where small variations in the data are assumed. That kind of analysis has sometimes been called “the theory of comparative statics.”³² It may be called “partial dynamics,” or “relative dynamics,” or simply “dynamics,” for it somehow follows the theoretical pattern of the

³¹ It may well be emphasized that we undertake these static investigations not merely for their own sake, but in order to apply them to the explanation of change.

³² According to Lionel Robbins, this phrase is attributed to Schams. See the latter's “Komparative Statik,” *Zeitschrift für Nationalökonomie*, Bd. II, pp. 27–61. But Robbins believes that the procedure of the analysis goes back to the time of the classical economists. See his *Essay on . . . Economic Science*, p. 101, footnote 1.

hog cycle or Cobweb Theorem.³³ But this study will go beyond this. Not only will it compare the two final states of equilibrium assuming given variations, but it will also endeavor to trace out the path actually followed by different parts of a system if a state of disequilibrium is given. This is the significance of Marshall's "period" analysis. It is to be pointed out, however, that in doing all this it is not assumed that final equilibrium is necessary.

In the next stage, the change in technology will be introduced, together with, first, a given, and then a changing population. This analysis is more than dynamic; it is evolutionary. Analysis of the evolutionary process is the main aim of the present essay. It is obvious to anyone acquainted with the procedure of economic analysis that the difficulties confronted in this part are more than in others, and some of them seem to be insurmountable. With an incomplete set of tools in hand, I shall, however, venture to try. First, starting with Chapter III, the process of industrialization will be systematically analyzed, considering both the basic factors affecting the process and its characteristics. This systematic treatment of economic development, I boldly call "the theory of industrialization." The next two chapters will examine the effects of technological changes involved in and working (through the process of this particular phase of economic transformation) on agricultural production and on rural labor. Here theories relating to the adjustments of the farm as a producing unit and to the remuneration of a factor of production (in this case, labor) are presented. The main parts of the analysis are, of course, those directly related to the evolutionary process, such as mechanization in agriculture, reorientation of the types of farming, and labor transfer from farm to factory.

Finally, the problems involved in and raised by the industrialization of an agricultural country will be analyzed. The problems have two sides: internal and external. The internal side will be exemplified by the case of China, in which emphasis is to be laid upon the relationships and possible ad-

³³ For a detailed analysis of the theorem, see Mordecai Ezekiel, "The Cobweb Theorem," *Journal of Farm Economics*, February 1938, pp. 255-280.

justments between agriculture and industry. The external side will touch upon trade and capital movement between countries. It is, on the whole, an application, though far from complete, of the theories of international trade and international capital movement to the explanation of the possible implications arising from the industrialization of an agricultural country. Difficulties confronted in this analysis are no less serious. This is because it also involves methodological adjustments which are to be made whenever an attempt is made to apply theories developed under static assumptions to explain an evolutionary process in economic transformation.

CHAPTER II

INTERDEPENDENCE OF AGRICULTURE AND INDUSTRY

CLOSE INTERDEPENDENCE of agriculture and industry has always existed in an economic society, although its patterns have undergone many changes in the process of economic evolution. It is too simple to say that one period in economic history is agricultural and that another is industrial. Even in the so-called "agricultural stage," the activities of artisans and craftsmen cannot be belittled. Some of these artisans were concentrated in small towns; some were distributed among the villages of the countryside; and the farm households supplied a large amount of part-time labor, which is often mistermmed merely agricultural. On the other hand, in the so-called modern "industrial stage," the importance of agriculture as a source of food and raw materials can hardly be exaggerated. However highly industrialized a country may be, it cannot continue its economic activities and develop them without, at the same time, either maintaining a fair and changing balance between agriculture and industry within its own boundaries, or securing a close contact, through export and import, with agricultural enterprises of other countries. Great Britain, for example, could not be so highly industrialized as is indicated by her occupational distribution of population and composition of national income had she not secured supplies of food and raw materials from other countries, such as Denmark, Canada, Australia, India, and South Africa. Besides serving as a source of food and raw materials, agriculture also furnishes for industry a source of labor recruitment. Finally, farm households also serve manufacturing industries as buyers not only of industrial goods for consumption purposes, but also of chemical fertilizers and farm machinery.

A. FOOD AS A LINKING FACTOR

Agriculture has been and still is the main source of food supply. The development of food processing and packaging industries is a matter of only recent history. These industries, as an independent field of production, could not have started or developed into the full-grown stage which they have reached in some highly industrialized countries, had not the process of refrigeration been developed and the modern railroad system established. But no matter to what extent the food processing and packaging industry further develops, agriculture will remain the major source of food supply so long as the food of human beings consists almost solely of plants and animal products.¹ The acreage devoted to food crops constitutes an overwhelmingly large part of the total. Among the plants grown on farms, only cotton, flax, grass, and a few others are not used as food for man. All other items are used either directly as food or indirectly as feed. Most animals and fowl raised on farms, as well as all dairy products, are used as food, except those raised either for producing wool and hides or for transportation purposes. Thus agriculture, first and most important, serves the whole economy of human society as a chief source of food supply.

Taking food as a linking factor, this section will discuss the relationship between agriculture and industry, considering food as a product supplied by farms and consumed by industrial people. The proportion of food products consumed by farmers themselves is assumed to be constant and hence negligible in the present discussion unless otherwise stated.

POPULATION AND FOOD

Assuming that no changes occur in taste and in income distribution, demand for food will be a function of population. This function can be further broken down into two parts: natural growth of population, and occupational shifts of popula-

¹ Among the few exceptions, fish and salt are the two most important items which come from sources other than agriculture.

tion — from agriculture to industry and to other fields of production.

Assuming no occupational shifts, demand for food will be a function of the natural growth of population. If we further assume that there are no changes in farm technology, then the growth of population will indeed cause a pressure on food supply. This theoretical case may be illustrated in the following simple way:

PERIOD	FOOD		POPULATION		
	<i>Required</i>	<i>Produced</i>	<i>Rural</i>	<i>Industrial</i>	<i>Total</i>
I	100	100 (units)	50	50	100
II	200	?	100	100	200

Suppose, in the first period, the total population of a given isolated society is 100, half rural and half industrial. In the second period, the total population is increased to 200, maintaining the same proportion of occupational distribution. Food required is increased correspondingly from 100 to 200 units. To what extent the food production will be increased depends on several factors: first, how much new land is available; second, in the same area of land, to what degree labor will be intensified. There are what are called, following the Ricardian tradition, "extensive" and "intensive" margins. In the third place, food production depends on changes in farm technology. This is a factor which either is not considered, or tacitly assumed constant by the classical writers.

Let us, for the moment, assume that no changes occur in farm technology and see how the increase of food production works out under the first two conditions — extensive and intensive cultivation. Suppose, in the first period, the rural population of 50 are laborers and are working on 200 acres of land. The product is 100 units of food. In the second period, the rural population (or laborers) is increased to 100. If there are 200 more acres of land available, then 100 laborers and 400 acres of land will produce 200 units of food. Therefore, no question will arise as to food supply and population pressure. But if there are less than 200 acres of new land available, the total

production of food will be less than 200 units, and, the food supply will be insufficient. If new land available is much below 200 acres, population pressure will soon begin to exert itself. On the other hand, if 200 acres of land is the maximum in a given society, then, the only way to increase the food production is to put more labor on the original land, especially since rural population has already been doubled. To be sure, to put more labor on a fixed area of land is different from changes in farm technology. Now, with 100 laborers and 200 acres of land, the production of food will be increased to more than 100 units, but, without the slightest doubt, will still be far below the required amount of 200 units. Again, population pressure will be in evidence.

Now, suppose that, from the first period to the second, there is no natural growth of population, and only an occupational shift from agriculture to industry — say, ten rural people shift and become industrial workers. The total amount of food required by the community remains the same. The effect of such a shift on the food situation is similar to that of the growth of population; that is to say, it will create a pressure on the food supply. But the extent of the pressure may not be the same. Most likely, a decrease of one-fifth of the rural workers will bring a less than proportional decrease in food production. This is because, first, the fifty rural people might not have worked to their full capacity, and hence after a shift of ten people to another field, the remaining forty people could work harder and make themselves equivalent to forty-five laborers. Second, assuming that there was no disguised unemployment before the shift, the decrease of food production may still be less than proportional owing to the operation of the law of diminishing returns. If we assume that neither of these two conditions has existed, the community must face a situation of food deficiency. In that case, there are only two ways to meet the deficiency in food supply. One is to bring about an improvement in farm technology. The other is to import from other communities the food products required and, in exchange for them, to export the increased industrial goods produced after the shift.

If the natural growth of population and the occupational shift occur at the same time, the problem of food supply appears to be essentially the same. If we assume that there are no changes in taste and in farm technology, the means to meet the deficiency in food supply would consist of any of the following three methods: extensive cultivation (more land), intensive cultivation (more labor on the same land), or import from outside (interregional trade); or a combination of any two, or of all three of them. History has shown that such cases have occurred in some countries. Even today, some countries are still being confronted with problems arising from such a situation, only in a more complicated form.² Problems of this sort can be satisfactorily solved only if something is done to induce improvements and technological changes in agriculture.³

² China may serve as an example. For many centuries her farm technique has remained essentially the same. But on the other hand, the natural growth of population and occupational shifts to a very moderate extent have continued. The problem of meeting the deficiency in food supply exists every year within some specific regions. The pressure of population on food supply has reached such a point that only changes in farm technology and trade with other countries can mitigate it.

³ After the present section was completed, the writer found Theodore W. Schultz's essay on "Food and Agriculture in a Developing Economy," in which he distinguishes three types of the rates of growth in the demand and supply of food and other farm products. The first type is that of equal rates of growth in the demand and supply of farm products. The second type of development arises when there is unequal growth, with the demand having a tendency to outdistance the supply. This type may be represented by China, India, and other parts of the world where farm technology has not yet met the demand of the growing population. It is also the type which we have included in our discussions above. The third type of development arises when there is unequal growth, with the supply of food leading. Food becomes more abundant and cheaper and rent payments fall; the scarcity of farm land recedes; and the fear of overpopulation disappears. A farm problem arises, and in bad times it may readily turn into an agricultural crisis. According to Schultz, contemporary experience is characterized by this type. Of course, he has in mind only highly industrialized countries, especially the United States, when he makes this statement. This type happens only when farm technology has been greatly developed and adjustments and reorganization in other aspects have not been introduced accordingly. The related problems will be taken up in the following chapters. For Schultz's essay, the reader is referred to *Food for the World*, edited by him (Chicago, 1945), pp. 308-309. For an elaboration of the third type, see his article, "Two Conditions Necessary for Economic Progress in Agriculture," *Canadian Journal of Economics and Political Science*, August, 1944, pp. 298-311.

FOOD AND THE LOCALIZATION OF ECONOMIC ACTIVITY

The first important aspect to be considered is the relationship between the regional distribution of food production and the patterns of population settlements. In an agricultural country, or in a country during the stage in which agricultural production is of primary importance and a larger proportion of the people are rural, the distribution of population is determined mainly by food production. In a study of the structure of the food economy of Kwangshi Province — one of the provinces in the rice-dominant area of China — I have made two maps showing the distribution of rice plantations and the distribution of population settlements.⁴ These two maps correspond exactly. The relationship between the two factors in question is so close that from the distribution of one the distribution of the other can be easily seen.⁵

The regional distribution of food production to a great extent determines not only the location, but also the types and activities of food processing industries and related crafts. For example,

rice-polishing and wheat-milling have become such important businesses that they have spread over the greater part of China and linked organically with the local economic structure in different regions. Their relative importance and types of organization and operation in different areas are closely connected with, and largely determined by, the local patterns of food production. Brewery, soybean-curd shops and oil houses are other kinds of food processing industries which constitute, on the one hand, an important source of farm income, and, on the other, one of the essential types of rural industry.⁶

The last but more important aspect, so far as the present study is concerned, is the relationship between the regional

⁴ Chang Pei-kang, *Food Economy in Kwangshi Province* (Shanghai, 1938; in Chinese), pp. 20-21.

⁵ Historical surveys of this kind for highly industrialized countries before they have undergone the process of industrial revolution would be helpful and convincing in supporting our statement. But, unfortunately, to the knowledge of the present writer, systematic surveys of that kind have not been made.

⁶ Quoted from a passage in my paper, "Food Economy in China" (mimeographed, 1944).

distribution of food production and the localization of those industries which do not use foodstuffs as raw materials. Before the process of industrial revolution was very far under way, the distribution of population, as just mentioned was dominated by the production of food. During this stage, industry and agriculture were closely associated. In regions with an abundance of food, large numbers of specialized industrial workers were maintained in close association with the agricultural workers.

This intimate relationship between industry and agriculture was due to the predominance of pure manual labor in all the more important branches of industry. So little power was used that the productivity of labor was low. Under these circumstances the weight of the food consumed was very much greater than the weight of the raw materials necessary to give employment to the artisans. The differences between the weights of food consumed and of the raw materials used were especially great in the case of the textile industries. Under such circumstances an industry based upon hand work can most advantageously be located with reference to the food supplies needed to maintain the workers.⁷

Thus, "prior to the eighteenth century, export industry was located in large measure in regions of cheap food production or in regions where food was cheap by reason of easy transport conditions."⁸

It is, therefore, superficial to speak of eighteenth-century Europe as being largely self-sufficient because there was little movement of primary foods. The effective utilization of local food supplies required important movements of primary raw materials and finished products. The interdependence of regions upon each other in 1700 must be considered primarily with reference to raw materials, supplementary foods, and highly manufactured products.⁹

⁷ Bowden, Karpovich, and Usher, *An Economic History of Europe Since 1750*, pp. 4-5.

⁸ Dean, *The Theory of the Geographic Location of Economic Activities*, p. 24.

⁹ Bowden, Karpovich, and Usher, p. 5.

From this it is clear that for any country, before industrial revolution took place, food was the main factor for the localization of all economic activities — industrial, commercial, or otherwise.¹⁰ As soon as industrialization in a country is appreciably under way, food resources begin to have less importance as a locational factor.

INCOME AND THE DEMAND FOR FOOD

Elasticity of demand is a measure of the “responsiveness of consumption” to a change in price. It was first conceived and put in a standard formula by Marshall,¹¹ as:

$$\frac{\frac{dx}{x}}{-\frac{dy}{y}}$$

And what we now call the coefficient of demand elasticity, that is,

$$\frac{\text{Expected per cent change in quantity demanded}}{\text{Expected per cent change in price}}$$

is substantially the same as the formula used by Marshall. If a commodity has a coefficient equal to one, it is said to have “unit elasticity.” If the coefficient is less than unity, the demand is called “inelastic,” if more than unity, “elastic.” The income elasticity of demand is a measure of the responsiveness of consumption to a change in income.¹² The coefficient of income elasticity of demand is expressed in the following form:

$$\frac{\text{Expected per cent change in quantity demanded}}{\text{Expected per cent change in income}}$$

¹⁰ It is needless to say that great trade centers are possible only in those areas where the food supply is sufficient in quantity and quickly accessible.

¹¹ Alfred Marshall, *Principles of Economics* (London, 1925), p. 102, footnote; and Mathematical Appendix, Note III, p. 839.

¹² R. G. D. Allen and A. L. Bowley use a different term, i.e., scale or order of urgency, to describe this relationship. See their *Family Expenditure* (London, 1935), pp. 9–15.

The relationship between a change in the amount of commodity demanded and a change in the income differs for commodities. A product is said to be inferior if a rise in income brings a decline in the amount consumed. The famous Giffen case (bread) is a typical illustration.¹³ In this case its income elasticity is said to be negative. If the amount of the commodity consumed remains the same as income rises, its income elasticity is zero. If the amount of the product consumed rises with rise in income, its elasticity is positive. If the amount consumed rises at the same rate as the income, its income elasticity is unity. If the amount rises more than income, income elasticity is greater than one, and vice versa.¹⁴ Price elasticity and income elasticity are mutually influenced. For example, a price change inevitably has an effect, however small, on real income.

The income elasticity of the demand for food is relatively low, that is, as income increases, the demand for food rises much less than proportionally. Failure of consumption generally to rise proportionally with higher income is a familiar economic relationship. Indeed, it is upon this relationship that much of Keynes's analysis and theory have been laid. Keynes's statement of the principle is that "men are disposed, as a rule and on the average, to increase their consumption as their income increases, but not by as much as the increase in their income."¹⁵ Our concern here, however, is with the circumstance that the consumption of food is less influenced by income than that of most other commodities.

Equally important, the income elasticities of the different foods vary greatly. The accompanying table, which shows the income elasticity of expenditures for some important food products in the United States, makes this point clear.¹⁶ It is to be noted that the income elasticity of "expenditure" is not quite the

¹³ Marshall, *Principles of Economics*, p. 132.

¹⁴ Margaret G. Reid has made a good analysis of this problem. See her *Food for People* (New York and London, 1943), Chapter 15, "Food Consumption by Income Level."

¹⁵ J. M. Keynes, *The General Theory of Employment, Interest and Money* (New York and London, 1936), p. 96.

¹⁶ From G. S. Shepherd, *Agricultural Price Analysis* (Ames, Iowa, 1941), p. 210, Table 17. See also U. S. National Resources Committee, *Consumer Expenditure in the United States* (1939), pp. 38-39.

same as the income elasticity of "demand," which is expressed in quantities. Nevertheless, the former can be employed, in a moderate degree, to illustrate the latter. With two items in this list, the increase in consumption is more than proportional to income.

INCOME EXPENDITURE ELASTICITIES
(United States)

<i>Articles</i>	<i>Elasticity</i>
Sugar	0.15
Potatoes	0.20
Flour	0.24
Bread	0.25
Milk, cream, ice cream	0.29
Butter	0.36
Eggs	0.66
Meat, poultry, fish	0.66
Fresh vegetables	1.16
Fruits	1.20

Thus, the statement that food consumption is a function of income requires some elaboration. First, it should be pointed out that the type of the function, rectilinear or curvilinear, depends upon the income elasticity of the particular product or group of products under analysis.¹⁷ Second, emphasis should be placed on the patterns of income distribution whenever dealing with the income elasticity of demand with respect to a community as a whole instead of any individual.¹⁸ Finally, it should always

¹⁷ The famous Engel's Law states the different effects of changes in income on changes in expenditure by classifying the budget-commodities into several groups. Allen and Bowley have reformulated this law more precisely on the basis of the rectilinear relationship between expenditure and income that they found from the factual data of the working-class budgets in the United Kingdom in 1904. See *Family Expenditure*, pp. 5-7.

¹⁸ Lord Keynes obtains the "propensity to consume" from the fundamental psychological law that "men are disposed, as a rule and on the average, to increase their consumption as their income increases, but not by as much as the increase in the income." (*General Theory*, p. 96) Here by "men" of course, is meant individuals, while the conception of the propensity to consume is supposed to be used for the community as a whole. The "compounded" market curves cannot be obtained from the individual functions simply by a process of summation. As Lord Keynes has pointed out in the same paragraph,

be borne in mind that the price elasticity of demand and substitutability must be taken into account simultaneously with the income elasticity of demand. The price elasticity of demand is in general dependent on, among other factors, the level of income or total expenditure.¹⁹ The relationship among the three factors — price elasticity of demand, income elasticity of demand, and elasticity of substitution — is very well described by Hicks's and Allen's simple and standard formula, stating that the price elasticity of demand is a weighted average of the income elasticity of demand and the elasticity of substitution.²⁰

in which he defines the conception of the propensity to consume for a community, the latter would partly depend on the principles on which the income is divided between the individuals composing the community in question. (*General Theory*, pp. 90-91)

Staehle has made this point more clear by asserting that the frequency distribution of individual incomes according to *size* and the division of the national income into the *functional shares*, e.g., from labor, entrepreneurship, or property, should be distinguished as well as emphasized. See Hans Staehle, "Short-period Variations in the Distribution of Incomes," *Review of Economic Statistics*, vol. XIX (1937). Also "Reply," by J. M. Keynes and "Rejoinder," by Hans Staehle, same journal, vol. XXI (1939).

¹⁹ Some writers have stated that demands tend to become more elastic as the income level rises. This is because substitution becomes easier for most goods as income rises. (Allen and Bowley, *Family Expenditure*, p. 125) Other writers differ by taking an exactly opposite view. They assert that demands tend to become less elastic as the income level rises. The reason is that, as income rises to a higher level, some former luxury goods may turn out to be those of necessity. The present writer is of this view.

The issue would be more clear if a distinction were made between the "objective" possibility of substitution that Allen and Bowley have chiefly in mind and the "subjective" practice of substitution toward which an individual would most probably tend. It is true that as income rises to a higher level, more substitutes would be available than before. But it does not necessarily follow that as substitution becomes easier, the income receiver in question would perform the substitution more often than before whenever price changes. As a matter of fact, as income rises to a higher level, less attention would be paid, or less responsiveness shown, to price changes by that individual. The price elasticity of demand for food would be almost zero to a millionaire or any very rich man. It is with this individual behavior, the most probable behavior, that we should be primarily concerned. (It should be acknowledged that the present writer owes much to Hans Staehle for arriving at this conclusion.)

²⁰ The original form of the formula is:

Price-elasticity of demand for $X = Kx \times \text{Income-elasticity of demand for } X + (1 - Kx) \times \text{Elasticity of substitution between } X \text{ and } Y,$

where Kx is the proportion of income spent upon the commodity X . See J. R. Hicks and R. G. D. Allen, "A Reconsideration of the Theory of Value," Part I, *Economica*, February 1934.

Thus the price elasticity of demand is not an independent index; it is reducible to the other two primary characteristics, the income elasticity of demand and the substitutability.

Much attention has been given to the relationship between the change in income and the change in the demand for food. National income and its changes are important to this discussion because they are an index of industrial progress and hence a good indication of the degree and speed of industrialization.²¹ As industrialization gets under way, income (real income) of industrial workers as well as of industrialists and merchants will rise continuously to higher levels. Under this condition, demand for food will increase, but by a much smaller proportion or at a greatly decreasing rate. This is due to the double operation of Engel's Law and Lord Keynes's fundamental psychological law of consumption, which has already been discussed. Engel's Law states, in part, that as family expenditure, which itself is a function of income, increases, the absolute amount used for food will increase but the proportion spent for food will decrease.²² However small a proportion of expenditure is for food, the demand for food for the community as a whole will in general increase as income rises to a higher level. Such an increase in the demand for food, together with that due to the natural growth of population and the occupational shift in population, will bring about a pressure on food supply unless farm technology improves and makes possible greater food production.

We have already noticed that the income elasticity of demand is different for different food products. Thus whenever the income of a whole community rises to a higher level, or whenever the income of some particular group increases while that of others remains the same, a shift in the demand for different food products — a shift toward the highly priced food products —

²¹ Increase of national income may be due to causes other than industrial progress, such as the expansion of foreign trade. But, in the last analysis, even the expansion of foreign trade must have close connections with the industrial progress, especially if the latter is defined as the changes that originate chiefly from technological development.

²² For a detailed discussion of Engel's Law, see C. C. Zimmerman, *Consumption and Standard of Living* (New York, 1936), especially pp. 117-118.

naturally follows. The latter, in turn, has great bearing on the shift of food production. However, a shift due to increase in income is far different from a shift due to the natural growth of population. In the case of population pressure, the shift tends to be for the "light-yielding" food projects to the "heavy-yielding" ones. It means that the food products which have more calories (calorie productivity per acre) take the place of those which have less, which has been called by some writers "the law of food production as influenced by population density."²³ This law can operate only in a state where technology is assumed unchanged, or changed to a negligible degree. This has been the case with China for centuries. On the other hand, when income level rises, the resulting shift is of entirely different character. "Protective" food products, such as meat, eggs, dairy products, vegetables, and fruits, tend to take the place of "energy-producing" food products, such as wheat, rice and other cereal products, potatoes, and legumes.²⁴ Such a shift, first in consumption and then in production, can be achieved only if farm technology improves. This is because, for the support of a given size of population, the protective food products require more land than energy-producing food products to supply an equal amount of calories.²⁵ If the improvement in farm technology fails to take place, or fails to proceed at a rate (which can be measured by the quantity of production) to match the new demand for protective food, deficiency in food supply will inevitably result. In that case, trade with other communities is one of the possible and most effective methods of remedy. But history has shown that progress in farm technology always goes side by side with industrial development. The question then be-

²³ Wilbur O. Hedrick, *The Economics of a Food Supply* (New York and London, 1924), p. 28.

²⁴ "Protective" food is richer in the nutritive elements of high quality, such as proteins, minerals and vitamins, while "energy-producing" food contains more carbohydrates and hence produces more energy. See League of Nations, Mixed Committee, *Final Report on the Relation of Nutrition to Health, Agriculture and Economic Policy* (Geneva, 1937).

²⁵ As to the productivity (in terms of nutritive elements) per acre for various food products, see Raymond P. Christensen, *Using Resources to Meet Food Needs* (Washington, D. C., 1943), published by Bureau of Agricultural Economics, U. S. Department of Agriculture; also J. D. Black, *Food Enough* (Lancaster, Pennsylvania, 1943), Chapter 12, pp. 131-143.

comes one of the difference in the rate of progress between farm technology and industrial development.

B. RAW MATERIALS AS A LINKING FACTOR

Agriculture, as one field of production, may be linked with industry, as another field of production, by raw materials. In this respect, agriculture serves as a supply source while industry serves as a demand power. Our analysis of the present relationship must be partial. On the one hand, not all industries have a demand for raw materials from agriculture, and, as a matter of fact, industry as a whole is tending to use more and more raw materials from sources other than agriculture. Such a tendency has two implications. New industries which use raw materials from sources other than agriculture are on the increase. Old industries which have long used only raw materials grown on farms are now turning to other sources. A conspicuous example of the latter is the textile industry which has turned from using exclusively cotton, silk, and wool as raw materials, to using in an increasing proportion of a mixture of old raw materials and rayon and nylon products. On the other hand, agriculture does not supply raw materials alone. The role of agriculture in providing food has been and still is predominant over its role of supplying raw materials,²⁶ although the role has been shifting from the former towards the latter ever since the exchange economy was introduced.

THE ACCELERATION PRINCIPLE AND CYCLICAL FLUCTUATIONS

The acceleration principle has been widely used for describing and explaining business cycles. As it has been well elaborated by Haberler,²⁷ the principle states that "Changes in demand for, and production of, finished goods and services tend to give rise to much greater changes in the demand for, and pro-

²⁶ Foodstuffs, in a way, may also be taken as raw materials for the food processing and packaging industry. But it is to be noted that processing and packaging as a production field are far different from manufacturing. In the present discussion, emphasis is placed on the manufacturing industry, which is now considered the only industry using raw materials in the strict sense.

²⁷ Gottfried Haberler, *Prosperity and Depression*, 3rd edition (Geneva, 1941), p. 88, also p. 304f. and p. 473f.

duction of, those producers' goods which are used for their production." Finished goods need not be interpreted in the narrow sense of consumers' goods, but as goods, at any stage, "finished" relative to the preceding stage of production. The acceleration principle holds, not only for consumers' goods in respect to the preceding stage, but for all intermediate goods with regard to their respective preceding stages of production. Slight changes in the demand for consumers' goods may thus be converted into violent changes in demand for goods of a more primary order; and, as this intensification tends to work through all stages of production, it is quite natural that fluctuations should be most violent in those stages which are farthest removed from the sphere of consumption. It may even happen that a slackening in the rate of growth of demand in one stage is converted into an actual decline in demand for the product of the preceding stage.

Agriculture is an enterprise of primary production, and is among those stages of production which are farthest removed from the sphere of consumption. The relationship between the changes of agricultural prices and those of industrial prices can be best explained by the acceleration principle.²⁸ From some statistical data of longer periods²⁹ several conclusions about the relationship may be drawn. First, both the agricultural and industrial prices have the same trend. Second, the amplitude of change in agricultural prices is always greater than in industrial prices. This is the essence of the acceleration principle. Finally, there is always a lag of one, two, or three

²⁸ John H. Kirk has stated implicitly the acceleration principle at the very beginning of his book. He says: "It so happens that during adversity the experiences of agriculture are more embarrassing and the problems more acute than commonly confront other industries. Conversely, when trade is buoyant, agriculture tends to be more than normally prosperous, and agricultural countries flourish and grow. In short, agriculture shares in the cyclical movements of trade in an exaggerated degree." See his *Agriculture and the Trade Cycle* (London, 1933), p. 3.

²⁹ See V. P. Timoshenko, *The Role of Agricultural Fluctuations in the Business Cycle* (Ann Arbor, Michigan, 1930), p. 17, Chart 8, Agricultural (Crop) Prices and Industrial Prices, Deviations from Trend, covering a period from 1866-1920. Also U. S. Department of Agriculture, *Agricultural Outlook Charts*, 1944, p. 8, Prices Received by and Paid by Farmers, Index Numbers, covering a period from 1910-1943.

years in the changes of agricultural prices behind the changes of industrial prices. These three — same trend, the accelerating effect, and a lag in change — are the main features pertaining to production of any two successive stages which are far enough apart to be distinguished from one another. In a way, it may be described as the relationship between demand (industry) and the derived demand (agriculture).

A study of the accelerating effect, and the lag, of agricultural and industrial prices naturally leads us to examine the role of agriculture in the business cycle and the relationship of agriculture and industry with respect to cyclical fluctuations. The old harvest-cycle school, of which W. S. Jevons, H. S. Jevons, and H. L. Moore³⁰ are the representatives, seeks to account for the periodicity of business cycles by establishing the existence of a similar periodicity in agricultural output. The chain of causation runs from cosmic influences to weather variations, from weather variations to harvest changes, and from harvest changes to general business fluctuations. But the theorists of this school fail to agree among themselves on the length of the harvest cycle, which varies from H. S. Jevons' three and one-half years to Moore's eight, and further to W. S. Jevons' ten and one-half years. Such a failure constitutes one of the major points on which objections against the school have centered.

Another view states that agricultural fluctuations are to be taken as only one of the important factors, instead of the sole or the most important factor, in generating business cycles. Of this view are, among others, A. C. Pigou, D. H. Robertson, and V. P. Timoshenko. Both Pigou³¹ and Robertson³² treat harvest variations as important potential causes operating to precipitate cumulative upward and downward movements, though they attribute to these cumulative processes a life of their own with periods determined partly by psychological and other factors and, in any case, with no relation to the periods of crop fluctuations. To them, fluctuations in harvest or in the output of ani-

³⁰ H. L. Moore, *Economic Cycles: Their Law and Cause* (New York, 1914).

³¹ *Industrial Fluctuations* (London, 1927).

³² *A Study of Industrial Fluctuation* (London, 1915), and *Banking Policy and Price Level* (London, 1926).

mal products may be regarded as analogous to inventions or wars, which appear at irregular intervals, and set in motion cumulative processes of expansion or contraction in the industrial system, or alternatively reinforce or retard a concurrent expansion or contraction.³³ Timoshenko, upon an analysis of statistical data in relation to the economic situations of the United States, arrives at the conclusion that the role of agricultural fluctuations as the direct or indirect cause of the business cycle in that country has been of great importance, especially during the forty years before World War I.³⁴ To him, the importance of agricultural fluctuations as a generator of cycles, as an outside impulse to business revivals and so to periods of prosperity in this country, seems unquestionable. His argument, briefly, runs as follows. Cycles in the physical volume of crops generate cycles in crop prices. These cycles in crop prices, though related in some measure to cycles in industrial prices, are not entirely coincident with them. Consequently, the ratio of agricultural to industrial prices also reveals cyclical fluctuations. A low ratio of agricultural to industrial prices generally precedes, or is coincident with, a business revival; a high ratio very often occurs during periods of great prosperity or financial stringency and precedes, or is coincident with, a recession. These facts indicate that business cycles may be caused, in part, by cycles in the ratio of agricultural prices to industrial prices. On his argument and conclusion, some comments may be made. It is true that the ratio of agricultural prices to industrial prices reveals cyclical fluctuations. But it is very doubtful that the ratio can be considered a cause of the business cycles. This is because the variations of the ratio during the various phases of the business cycle are, in the last analysis, due to the fundamental characteristics inherent in the production structure of agriculture and industry, which can be best explained by the acceleration principle. These variations are a result, rather than a cause, of the business cycles.

³³ For further discussion on this view, see J. H. Kirk, *Agriculture and the Trade Cycle*, Part II; and Haberler's *Prosperity and Depression*, Chapter 7, "Harvest Theories: Agriculture and the Business Cycle," especially p. 153 and pp. 155-158.

³⁴ Timoshenko, *The Role of Agricultural Fluctuations in the Business Cycle*.

A third view, represented mainly by American economists such as Alvin H. Hansen and J. M. Clark denies that fluctuations in agricultural output are among the causes of the cyclical fluctuation of business. Agriculture, in their view, is not an active but a passive element. It has been well analogized by Hansen that agriculture is becoming more and more the "football of business."³⁵ Hansen's argument, as presented in his article just cited, may be summarized as follows. First, through the work of Ragnar Frisch, Kondratieff, and others, we have learned that what has commonly been called *the* business cycle is in reality a component of *many* cycles, of which the cycle in agriculture may be one. It does not follow, however, that the business cycle is exclusively or even predominantly a resultant of the agricultural cycle. Second, the problem of the relation of agriculture to business cycles would be fairly simple could it be shown that sporadic oscillations in agriculture now and then generate business cycles without themselves running in cycles. The solution would then lie along the lines suggested by Pigou and Robertson. But if it be true that agricultural production and prices themselves run in cycles, the problem becomes far more complicated. Granted that such cycles do exist, the nature of the casual interrelationship is by no means clear. Third, the cyclical variations in agricultural prices are to be explained not by fluctuations in volume of output,³⁶ which in point of fact is relatively constant, nor by inelasticity of demand for farm products, but by the shifts in the demand schedule for farm products as a whole, due to the fluctuations of business, and the consequent changes in the absorptive capacity of industry as a buyer of farm products. Upon these and other related points, Hansen advances the thesis, admitting at the outset that it is only a hypothesis, that, in the main, agricultural price cycles, and even to some extent agricultural production cycles, are dominated by the business cycle. However, he doubts that it is yet possible to

³⁵ Alvin H. Hansen, "The Business Cycle and Its Relation to Agriculture," *Journal of Farm Economics*, January 1932, pp. 59-67.

³⁶ Hansen differs on this point from Timoshenko, who takes the view that the fluctuations of agricultural prices are chiefly dependent upon agricultural production and almost wholly independent of business.

arrive at definite conclusions with respect to the precise nature of the relation of agriculture to business cycles.

Haberler takes a view which seems to be a compromise of the above three, especially the last two, arguments. He says that these three points of view are not necessarily mutually exclusive. It is possible to reconcile a general lack of response on the part of agricultural output to changes in demand with occasional or periodic spontaneous variations which may have an effect on business.³⁷ After a discussion of the various ways in which agricultural fluctuations may influence general business, and the ways in which industrial fluctuations may influence agriculture, Haberler reaches the following conclusive statement: There can be no "agriculture theory" of the cycle in the sense of an alternative to, say, the monetary theory or the over-investment theory any more than there can be an "invention theory" or an "earthquake theory." All that can be attempted in this direction is to bring out the importance of agricultural fluctuations as one among other potential stimuli in the economic system.³⁸ This statement is in line with Pigou's view. As to the question whether a good harvest is good for trade and a bad harvest bad for it, Haberler takes a view which, I think, is very sound and should be generally accepted. He says that, first, it depends on the phase of the business cycle in which the disturbance occurs. It is conceivable that a good harvest may exercise now a stimulating and now a depressing influence according to the phase of the cycle and to the portions of the earth's surface and the world's population affected. Second, it must not be too readily assumed that a good wheat crop and a good cotton crop have the same kind of effect. The fact that different crops will have different effects on industry and trade should receive consideration. Finally, it still remains to be considered to what degree crop fluctuations are cyclical and, if they are cyclical, to what degree they are spontaneous and independent of the general business cycle.³⁹

This discussion of the role of agriculture in the business cycle

³⁷ Haberler, *Prosperity and Depression*, p. 154.

³⁸ Haberler, *Prosperity and Depression*, pp. 163-164.

³⁹ Haberler, *Prosperity and Depression*, p. 164.

and its relations with industry in cyclical fluctuations ranges from one extreme view that agriculture plays the sole or predominant role in the economic fluctuations to another that agriculture is nothing but the football of business. To the present writer, differences between these views nearly disappear or, at least, the issue becomes clearer if we recognize the significance and implications of historical development. If we mean by business cycle something that can happen only after modern capitalistic economy has developed to an advanced stage, agriculture is bound to play a passive role in the business cycle and to become more and more the football of business. But, on the other hand, if we interpret business cycle in a broader sense in which we mean even the cyclical fluctuations of economic activities before the period, or in the early stages, of industrial revolution, agriculture would play an important role, even a predominant one, during a certain period in a certain region, in generating and shaping business cycles. History has shown that during the process of industrialization food and agricultural raw materials have relinquished their role in the localization of economic activities to mineral resources, such as coal. The same seems to have happened to their role in the generation and shaping of the cyclical fluctuations in economic activities. Furthermore, if we, in explaining economic progress and cyclical fluctuations under the modern capitalistic system, adopt a view that only the enterprising spirit and technology are generating factors,⁴⁰ while the institutional forms, such as production structure and trade organizations, are at most modifying and shaping factors, the present controversy is almost entirely irrelevant.

With these implications in mind we may arrive at the following conclusion: whether agriculture plays a role, and what kind of a role, in the business cycle depends upon the concept of business cycle accepted, as well as the philosophy of economic evolution adopted. Furthermore, the role of agriculture does not remain the same throughout the economic development; because of the inelasticity of supply and other characteristics in its production, agriculture, as revealed in price behavior, is usually subjected to greater changes than industry during cy-

⁴⁰ See Chapter III, Section B, for discussion of this point.

clical fluctuations. Agricultural prices always rise more than industrial prices during a boom, and fall more during depression. This, however, does not indicate that income changes necessarily follow the same pattern. On the contrary, the relations of farm income to urban-labor income and capital income present a rather different picture.⁴¹

COST OF RAW MATERIALS AND LOCATION OF INDUSTRIES

Some industries use agricultural products as raw materials, among which we may mention the textile, leather, shoe, food processing, and packaging industries. In the cost structure of these industries, cost of raw materials usually occupies an important, and in some cases a predominant, place. Let us take the cotton textile industry as an example. In China, according to an investigation undertaken in 1933 by the Institute of Social Sciences, Academia Sinica, cost of raw materials was 30.5 per cent of total cost for the 14 pounds-crude cloth, and 27.4 per cent for the 12 pounds-fine cloth, compared with the direct labor cost, 34.3 per cent and 30.7 per cent respectively.⁴² In the United States, according to an investigation made in 1935, cost of raw materials for different fabrics varies from 33.1 per cent to 60.7 per cent of the total cost, exclusive of selling expense.⁴³ Data are lacking as to whether for any single industry the industrial progress or technological improvements have made the percentage cost of raw materials higher or lower in the cost structure. It may, however, be reasonably assumed that either might have happened. Here we want only to emphasize the fact that the importance of the raw-material cost in the cost structure of an industry has two effects. First, the industry that uses the raw material and the farms that supply it are mutually affected in boom, in depression, and in normal years. The changing relations of farm income to the profits of the industries that

⁴¹ Consult Black's *Parity, Parity, Parity* (Cambridge, Mass., 1942), Chapter 8, "The Three Shares of National Income," and Chapter 9, "Farm vs. City Incomes."

⁴² Wang Chih-chien and Wang Cheng-chung, *Report of a Survey on Cotton Mills in Seven Provinces of China* (Shanghai, 1935; in Chinese), p. 222.

⁴³ H. E. Michl, *The Textile Industries: An Economic Analysis* (New York, 1938), p. 111.

use agricultural raw materials are a good, although partial, indication of these mutual effects, of which more will be said in the last section of this chapter. Second, raw-material cost greatly influences the location of an industry. It is with this aspect that we are mainly concerned at the present.

Source of raw materials is unequivocally one of the major factors that determines industrial location, although its importance varies with different industries, depending upon the characteristics of their production structures. Edgar M. Hoover, Jr., in his study of the location of manufacturing industries, asserts that

the advantages of integration between successive stages of a process further encourages location of any given stage of production either at the source of its *materials* or at the point of consumption [market], rather than at any intermediate point.

This is because

when there are two materials and production is at the source of one of them, or at the market, only two shipments are involved. When production is at some "separate" fourth point, three shipments are required. Consequently we may say that whenever the minimum-transport-cost point would be fairly near one of the corners of the locational figure in the absence of a "loading cost," the presence of such a cost will shift it to that corner. This further restricts the possibility of a "separate" production location away from market and materials.⁴⁴

He thus concludes that much of the geometrical analysis of transport orientation in terms of separate production points is rather useless.⁴⁵ Besides source of materials and market, Hoover introduces another locational point, that is, natural breaks in transportation " . . . a port, a portage, or a railhead, for example . . . may offer the same advantages as a material or market location in so far as the minimizing of the number of hauls and loading charges is concerned."⁴⁶ Therefore, according

⁴⁴ Hoover, *Location Theory and the Shoe and Leather Industries*, p. 57.

⁴⁵ Usher maintains the same view in his *Dynamic Analysis*.

⁴⁶ Hoover, p. 58.

to Hoover, the influence of transfer costs practically tends to locate production at markets, at sources of materials, and at junctions or breaks in the transport network.

Given the "state of the arts" that includes mainly the technique of production, localization of economic activities is determined by the patterns of population settlement and the distribution of natural resources. This implies that given the technology, location of industries is determined by the forces operated from both the market and the source of materials. But market and source of materials are not mutually exclusive. It has been shown historically that at the early stage of economic development, they were harmonized with each other and, in some cases, even identified as one. The economy of family agriculture and household industry is a typical example of it, and exists in many countries even today. The "basic agricultural stratum" of population, as Weber and Ritschl call it,⁴⁷ is located quite simply according to the distribution of natural resources, with the more fertile districts presumably more intensively occupied and cultivated. With transportation improvements, trade and local specialization develop. A second stratum of population then comes into being, carrying on simple village industries for the farmers. Since materials, market, and labor are all furnished originally by the agricultural population, the new "industrial superstructure" is located with reference to that "basic stratum." It is clear that at this stage of economic development, market and source of materials are eventually identified as one locality.

Separation of market from source of materials starts and goes along with the process of "urbanization," of which industrialization is but one, though the most phenomenal, stage. At this stage, market and source of raw materials exist as two separate forces determining the location of industries. Whether an industry should locate at the source of materials or at the market is principally a question that relates to the characteristics of the production structure. Briefly, it depends on the relative

⁴⁷ See Weber, "Industrielle Standortslehre"; *Grundriss der Sozialökonomik*, vol. VI; Hans Ritschl, "Reine und Historische Dynamik des Standortes der Erzeugungszweige," in *Schmollers Jahrbuch*, 1927, pp. 813-870; and Hoover, p. 284.

importance of the cost of raw materials compared to the total production cost. It can be safely stated that for a group of industries which use the same kind of raw materials but operate at the successive stages of production, those of the earlier stages would be located nearer the source of materials than those of the later stages. A good example may be cited from Hoover's analysis of the relation between the leather and shoe industries. He considers the leather and shoe industries successive stages in one process. For the same reasons most processing and milling industries are located nearby the source of materials.

The leather industry [he says], during most of its history and in most of its branches, has been located primarily with reference to the cost of transportation of one or another of the materials, and illustrates the behavior of a large class of industries of which that may be said. Shoemaking, on the other hand, is equally representative of a large class of industries in which costs of transportation have generally been unimportant in comparison with such advantages as trained labor.⁴⁸

Technological changes relocate industries, even those which use primarily agricultural products as raw materials. This is because, on the one hand, technological changes essentially remodel the cost structure of an industry; and, on the other hand, they create new kinds of external economies or create opportunities for utilizing the old ones.

C. LABOR FORCE AS A LINKING FACTOR

The first section has considered the problem of population and demand for food. In the present section, population will be viewed as the source of supply from which the labor force for both agriculture and industry is drawn. Taking population as the source of labor supply, the first problem to be treated is that of the "optimum" population, given a group of natural resources and a stage of technological development. The second problem is the occupational distribution of population, especially that between agriculture and industry.

⁴⁸ Hoover, p. viii.

POPULATION AND LABOR SUPPLY

The economists of the orthodox tradition have tended to regard the term *supply of labor* as synonymous with the total population. They were thinking only of long-run and not of short-run changes when they spoke of shifts in the labor supply which would be occasioned by variations in the rate of remuneration. It appeared to them that, at any one time, the supply of labor was fixed when total population was given. The unsoundness of this view was pointed out long ago by Longe in his attempted refutation of the wage-fund theory. He said that

A supply of labour is a supply of potential work and every practical man knows that the quantity of work to be got from labourers is no more determined by their numbers, than the quantity of apples to be got from an orchard by the number of trees in it.⁴⁹

In modern times, besides other writers who have occasionally pointed out the defects of the traditional view, Douglas, in his valuable analysis of the theory of wages, has launched a strong argument against it, which runs as follows:⁵⁰

The supply of labor may differ very appreciably between two countries which have equal populations and identical age distributions. First, within the same age-groups the proportion gainfully employed may vary because of differences in social tradition and in wages. Second, the number of hours worked per day may differ. Third, the number of days which the worker absents himself from labor may differ. The supply of labor is not, therefore, as most classical economists have conceived it, identical with the *stock* of labor available but may vary quite widely as between two otherwise identical populations. It follows, therefore, that changes in the rate of remuneration may affect the quantity of labor which offers itself at any one time, since each of the three variables enumerated above may fluctuate with variations in the rate wages.

⁴⁹ F. D. Longe, *A Refutation of the Wage-fund Theory* (Baltimore, 1904; reprinted under the editorship of J. H. Hollander), pp. 55-56; original printing, London, 1866.

⁵⁰ Paul H. Douglas, *The Theory of Wages* (New York, 1934), pp. 269-270.

Practical economists⁵¹ who have been outside the classical traditions have recognized this tendency of the short-run supply of labor to bear some functional relationship to the rate of wages. The majority of the English mercantilists of the seventeenth and eighteenth centuries, for example, believed that the supply curve of labor was "negatively" inclined, and that an increase in wages caused a decrease in the amount of work done and that a decrease in wages would cause laborers to work more hours. That the supply curve of labor, in so far as the proportions employed are concerned, is negatively inclined has been statistically confirmed and reinforced by Douglas.⁵²

As to the relationship between wages per hour and the number of hours worked, which is to be considered as a main variable in the short-run supply of labor, Knight has pointed out that a worker would rationally work only to that point where the utility or satisfaction derived from the money received for the last unit of employed time was just equal to the disutility experienced as a result of that same unit of work.⁵³ Increases in wages would cause a decrease in the quantity of labor offered, while a decrease in wages would presumably have the opposite effect. He therefore believed that the short-time supply curve of labor so far as hours were concerned was negatively inclined. The soundness of this line of reasoning has been challenged by Lionel Robbins who has pointed out that were it invariably true then no one would work longer hours in return for a higher income. He reasons, with logic, that whether or not one works shorter hours with more pay or longer hours with less, depends on the elasticity of demand for income in terms of effort.⁵⁴ Robbins does not, however, define "effort," and this ambiguity makes his argument seem more difficult than it really is.

The present essay will not enter this controversy. Here only two points will be made. First, the question of whether a la-

⁵¹ A term used by Douglas; see his *Theory of Wages*, p. 270.

⁵² *Theory of Wages*, Chapter II, "The Short-run Supply Curve of Labor," especially pp. 272-294.

⁵³ Frank H. Knight, *Risk, Uncertainty and Profit* (Boston and New York, 1921), pp. 117-118.

⁵⁴ Lionel Robbins, "On the Elasticity of Demand for Income in Terms of Effort," *Economica*, June 1930, pp. 123-129.

borer works for more hours when wages decrease and curtails his working hours when wages increase can be answered only with reference to the "income level" to which his earnings belong. The effect in question is most likely to operate for laborers of lower income levels, while for those of higher income levels it is usually not likely. But what income level should be considered low and what considered high depends upon many factors, and varies from country to country, and changes from time to time. Secondly, that the supply curve of hours of work is negatively inclined with respect to earnings may be best indicated by agriculture. During depression or in a time of bad harvests, farmers tend, and in some cases are bound, to work longer hours, mostly in side-line industries, in order to meet the requirements of a living that is tolerable to them. This is true on commercialized as well as on peasant farms. The experience of American farmers during the great depression which began in 1929 is a good example. The real income of the farmers per unit of product and per hour of work greatly declined. The farmers attempted to counterbalance this shrinkage at least in part by working longer hours. The same happened for farmers in the eastern part of China around 1929 when silk exports drastically declined and reduced in a great measure the farm income for that region.

The long-run supply of labor is determined not only by all the factors which influence the short-run supply of labor but also by the volume and rate of population growth.⁵⁵ The growth of population works with effects in two directions. One is on the demand side where it brings new demand for food and for other necessary consumption goods. The other is on the supply side where it brings into the economic society a new labor force which will be used either for exploitation of new territories and for undertaking of new industries or for intensification of old production lines, or will be merely put aside in idleness. If these two forces of the opposite sides are kept at a rate of progress which equals the old one, as in Cassel's "uniformly progressive

⁵⁵ See Douglas' *Theory of Wages*, Chapter 13, "The Long-run Supply of Labor as Conceived by Economists and Students of the Population Problem," in which he discusses the problem in question from Malthus' theory of population to Raymond Pearl's law of population growth.

state,"⁵⁶ there will arise no new maladjustments. If forces of one side exceed those of the other, for example, if demand for food exceeds the increased production of the new labor supply, even taking into consideration the new product that can be used for exchange with other communities, a lowering of the standard of living for the community in question is bound to occur. The classical theory of population, from Malthus downward, has kept only this aspect in mind. It should be pointed out that the classical theorists have not considered the factor of the increase in productivity. In a stationary economy in which productivity does not increase, or increases at a rate which does not compensate for the difference by which demand overrides the supply, the law of diminishing returns is likely to operate, especially in agriculture. This would of course make food shortage a more serious problem as time goes on. But productivity and its rate of increase is such an important factor that no one dealing with economic problems can afford to neglect it. It is on this ground that the classical theory of population gives way.

By taking into consideration changes in productivity, the modern approach of "optimum" population is quite different from that of the classical economists. The idea of improvements as changes in the technique of production which may sometimes make a larger, and sometimes a smaller, population desirable, was completely foreign to the classical theory. The optimum of J. S. Mill, who is considered by some writers the father of the optimum theory of population, is fixed once and for all, and is unaffected by any improvement whatever. The optimum of modern theory, on the other hand, is one which is continually shifting; it is essentially a function of the "progress of improvement."⁵⁷

⁵⁶ Gustav Cassel, *Theory of Social Economy*, English edition (London, 1932), I, 34. It is to be noted that Cassel's uniformly progressive state does not present any essential differences from a stationary state, because in both cases, there is no increase in per-capita capital.

⁵⁷ Robbins, "The Optimum Theory of Population," in *London Essays*, p. 111. That the optimum population must be a "changing" figure and that the concept should relate to "productivity" was long ago suggested by Edwin Cannan. As early as 1888, when Robbins' *Elementary Political Economy* was first published, he said in the preface (p. 111) that "it is not true that an increase of popula-

Given an increasing measure of birth-control, the direction and pace of which are mainly determined by economic factors, or standard of living, and constant progress in the arts of industry, the "optimum population" will be a moving figure that will give the *highest income per head*.⁵⁸

Thus an area is "over-populated" when *total returns per head* (per capita) are less than they would be if the population were a little smaller, and this is a point which may be reached long before there is any question of "pressure on the means of subsistence."⁵⁹ On the whole, the approach by modern economists is concerned with the relation between the "size of population" and "productive efficiency," or, in other words, the amounts of all the other factors which coöperate with labor in production and the technical coefficients of production. From a consideration of this relationship arises, as against Malthusian maximum population, the concept of an "optimum population" consistent with a given amount of subsistence. The optimum population is that population which, with given amounts of other factors (including land, productive technique, capital, and organization), will produce the "maximum product." Any increase or decrease of the population above or below that size will diminish the product.⁶⁰ This optimum, in contrast with the one proposed by J. S. Mill, is *not* a size fixed for all time: it is determined only by reference to all the other data of the economic system.

OCCUPATIONAL SHIFTS OF POPULATION

Trade and migration of labor are generally considered as alternatives. This means that any two regions may exchange either their finished products or their factors of production, of

tion must always diminish the productiveness of industry or that a decrease of population must always increase the productiveness of industry. No more is it true that an increase of population must always increase the productiveness of industry, and a decrease, vice versa. The truth is that the productiveness of industry is sometimes promoted by an increase of population and sometimes by a decrease of population."

⁵⁸ J. A. Hobson, *Economics and Ethics* (New York and London, 1929), Part IV, Chapter 6, "An Optimum Population," p. 345.

⁵⁹ Robbins, "The Optimum Theory," p. 120.

⁶⁰ Roll, *Elements of Economic Theory*, p. 215.

which labor is considered a primary one. A different way of saying the same thing is a statement made by Rosenstein-Rodan that "if the principles of international division of labor are to be applied, *labor* must either be transported towards capital (emigration), or *capital* must be transported towards labor (industrialization)." ⁶¹ This is true as well for interregional movements within a political regime. However, a distinction must be made between labor migration from one region to another and labor transfer from agriculture to other production fields. Labor migration is in most cases due simply to the pressure caused either by famine or by a surplus in the local labor supply. Migration in the Asiatic countries, such as migratory movements from India and China to areas in the South Pacific, is a typical example. Here technological changes are not necessary. Such transfers are in the nature of "extensification," rather than "intensification," of production. Labor transfer from agriculture to other production fields, on the other hand, is due mainly to the technological changes occurring in a given economic society, or due to the increased demand for labor in other production fields, such as industry and trade, simply because of expansion. Labor transfer in this sense is a change of occupation or employment, and thus it may or may not cause migration of labor between regions. It could occur long before industrialization takes place, but the latter has made it and will continue to make it operate most impressively in the history of economic evolution.

The basic reason for occupational shifts, as revealed in the labor transfer from agriculture to other production fields, may be found in the differences of the per-capita monetary returns. While it is difficult to make any accurate calculation concerning the incomes derived from agriculture, it seems safe to say that, excluding large farmers in the newer countries, plantation owners in colonial countries, and a few large European farmers — these form only a very small proportion of the total number of farmers — the actual return per capita from farming is smaller than that derived from industrial, commercial, and

⁶¹ P. N. Rosenstein-Rodan, "Industrialization of Eastern and Southeastern Europe," *Economic Journal*, June-September, 1943, p. 202.

professional occupations.⁶² Such a difference or gap becomes greater when industrial and commercial expansion is on the way, especially during early stages of industrialization. However, the difference in monetary returns is not the only reason for labor transfer between production fields, and further discussion of this point will be found in Chapter V. It is also to be recognized that there are many factors which offset the low monetary returns in agriculture and contribute to keeping agricultural labor from moving to other production fields. Among these are the element of security attached to the possession of land, independence of the peasant from the regimentation inevitable in industry, and satisfaction derived from seeing the living results of labor in plants, trees, crops, and animal life.

Another factor to be noted in the mobility of labor and in the determination of gainful employment is the composition of the family. If we assume that the location of the family is dominated by the activities of the chief breadwinner, gainful employment must be sought by the other members of the family in that locality. The labor force represented by these members of an established family seeking employment can best be described as "externally conditioned" labor. The location of such workers is determined by conditions external to the employment which they find.⁶³ Any economic activity which draws by positive factors a certain number of chief breadwinners will give rise to a reserve of labor available for other occupations.

Statistics for the United States have shown that from 1870 to 1940 agricultural labor has decreased both absolutely and relatively. In absolute numbers, agricultural laborers in 1940 were only 56.6 per cent of those in 1870, in spite of the fact that the total number of workers of all kinds increased three times in the period concerned. In percentage agricultural labor has decreased from 47.3 per cent of total workers in 1870 to 17.5

⁶² For example, in the United States, it has been statistically shown for the year 1924 that the income per capita of persons engaged in agriculture (annual average \$281) was found to be about two-fifths of the average income per capita in all occupations (annual average \$712). See Royal Institute of International Affairs, *World Agriculture: An International Survey* (London, 1932), p. 59.

⁶³ Usher, *Dynamic Analysis*, p. 43.

per cent in 1940. Workers in the manufacturing and mechanical industries have maintained the same relative importance (around 28 per cent of the total) throughout the period, yet their absolute number has trebled. Workers in transportation and in trade have both increased ten times in the period; their relative ratios have been raised respectively from 3.2 to 9.2 per cent and from 4.6 to 13.8 per cent. Both absolute number and percentage have been tremendously increased in the same period also for persons engaged in professional service, public service, and clerical occupations.⁶⁴ Such a type of occupational shift — a permanent or long-run transfer from agriculture to other production fields — is among the main features that characterize the process of industrialization.

The historical aspect of occupational shifts may be linked with the locational aspect of economic activities. When industry and agriculture were closely associated, their localities were almost identical. That is to say, both industrial and agricultural activities were centered in places where food and other resources for the necessities of life were abundant. At that time industrial and agricultural labors were almost identical or, at least, closely associated. Not only were large numbers of specialized industrial workers maintained in close social and economic association with agricultural workers, but also the farm households supplied large amounts of part-time labor for industries which were located nearby. When commercial expansion was under way, ports or junction points of rivers became centers in which persons engaged in trade and where light industries were converged. Labor migration as well as occupational shifts began to occur, and trade and allied activities began to separate from agriculture. It was not until the period of the so-called Industrial Revolution that such separation, more particularly the separation of industry from agriculture, began to operate effectively and impressively. It is evident that different industries have different locations, determined in the main by the resources and labor they employ in terms of their cost structure, given a state of technological development. In some cases,

⁶⁴ Statistical sources, H. D. Anderson and P. E. Davidson, *Occupational Trends in the United States* (Stanford University, 1940), Table 4, pp. 16-17.

such as the leather industry, resources — raw materials — were the major factor determining the location; in some cases, such as the shoe industry, labor was the chief one.⁶⁵ But, in the last analysis, in a society where industrialization has already begun, power resources, of which coal is most representative, are to be regarded as the main factor in the localization of economic activities. This is because in modern society some industries which must use coal as power have become so predominant that other economic activities must be accordingly adjusted and re-oriented. In this case, labor as a social factor of production must submit to the power resources which are geographically localized.⁶⁶

Besides the "long-run" occupational shifts, there is "seasonal" as well as "cyclical" labor transfer between different productional lines. Seasonal transfer occurs most frequently in crop farming during the period when harvesting is finished and sowing is not yet begun. During that period there is a temporary surplus in agricultural labor, even assuming that all farmers were fully employed in cropping time. This is especially so in a peasant country where industries are almost entirely small scale, and are located not far from the residence of farmers. Such industries are among the so-called "rural industries," which have long been the "side-line" undertakings for rural families. There is even seasonal migration between different countries. This has happened in continental Europe as well as in Great Britain, where transport facilities made the migration possible. For example, before World War II started, Irish laborers came into England and Scotland every year for harvesting and potato picking, and a large number of Polish agricultural workers moved annually into Germany for sugar-beet cultivation. The German employers maintained that it would be impossible to carry on the sugar industry without the assistance of the Polish workers, owing to the seasonal nature of the work, the comparatively high wage demanded by German workers, and the rural exodus of the latter to the towns. On the eve

⁶⁵ Hoover, p. viii.

⁶⁶ It should be noted that transmission of electrical power also has had revolutionary effects on the locational aspect of industry.

of World War I annual seasonal migration from other nations, mainly Poles from Russian territory, to Germany had increased to 40,000.⁶⁷ This labor movement between regions differs from an occupational shift that requires a change in production lines, but it has profound bearing on the occupational shift, because it saves for the region or country into which workers have moved an amount of native labor that can be transferred into other production fields.

Cyclical labor transfer between production lines presents different pictures, depending on the phases of the cycle under analysis. During the upswing there is a tendency for agricultural workers to move into industrial lines, because by that time a great industrial as well as commercial expansion is under way while agricultural production has been kept more or less steady. The boom caused by World War II is a typical case. Many workers, including women and children, moved from farms, along with those already in the urban areas, into the war plants. Such a cyclical transfer may turn out to be a long-run transfer if the boom can be maintained. But usually when a boom is over those who are "last in" are "first out." These workers will have to go back to their original occupations, most of them back to agriculture, some staying home and some shifting to other production lines which are even less remunerative. This leads to a situation of "disguised" unemployment.⁶⁸ It is, however, to be noted that wage rigidity as caused by labor union movement and social insurance as promoted by government action also have some influence on labor transfers during depression. Wage rigidity is clearly shown, for example, for the United States in that during the depression of the 1930's, agricultural net income largely disappeared, likewise capital in-

⁶⁷ *World Agriculture: An International Survey*, p. 68.

⁶⁸ In interpreting "disguised" unemployment, Joan Robinson says: "A decline in demand for the product of the general run of industries leads to a diversion of labor from occupations in which productivity is higher to others where it is lower. The cause of this diversion, a decline in effective demand, is exactly the same as the cause of unemployment in the ordinary sense, and it is natural to describe the adoption of inferior occupations by dismissed workers as 'disguised' unemployment." See her *Essay in the Theory of Employment* (London, 1937), p. 84.

come, but wage rates continued to remain on a relatively high level.⁶⁹ It has been an extreme view that price-wage rigidity or inflexibility is a necessary condition underlying the existence of unemployment. According to this view, the tendency for labor to transfer back to original, or shift to other, occupations during depression under the form of disguised unemployment is hastened by wage rigidity.

D. THE FARMER AS A BUYER AND A SELLER

The classical economists have made their analysis, with almost no exception, upon the assumption of free and perfect competition. It is only in the last two decades, especially since the publication of Joan Robinson's and Chamberlin's books in 1933, that the theory of imperfect and monopolistic competition has been given more attention, particularly in dealing with economic policies. But it is still generally assumed that imperfect or monopolistic competition⁷⁰ exists only in industrial markets (markets for industrial goods), while in agricultural markets (markets for agricultural goods) perfect competition or something approaching it has long existed and still prevails. A further investigation into the facts makes one recognize how unrealistic is the assumption that perfect competition prevails in agricultural markets.⁷¹ It is unrealistic not only in modern capitalistic society, but also in a society where industrialization has not taken place. It should be pointed out, however, that the concept of perfect competition itself has been changing all the time

⁶⁹ Black, *Parity*, pp. 100-101.

⁷⁰ The term "imperfect" competition and the term "monopolistic" competition are used here interchangeably under the assumption that their differences are not so great or so significant as to invalidate the general statements in the present analysis. But their distinction must be borne in mind, for which Chamberlin has specially and painstakingly written an article ("Monopolistic or Imperfect Competition?" *Quarterly Journal of Economics*, August 1937, pp. 557-580). J. A. Schumpeter has made a distinction between the two by taking "monopolistic" competition together with bilateral monopoly and oligopoly as three standard instances of "imperfect" competition (*Business Cycles*, I, 57).

⁷¹ Some writers have recognized this point, for example, W. H. Nicholls in his *Theoretical Analysis of Imperfect Competition with Special Application to the Agricultural Industries*, which so far is almost the only systematic treatment of the subject. Most writers, however, have not examined the periods preceding modern capitalism.

since economics as a science was first established. According to the rigid standard set by modern economists for perfect or pure competition, under which any kind of locational limitations, service differentiation, institutional obstacles, and human ignorance must be excluded, there has never been such a thing as perfect or pure competition in our history and, very probably, it will never actually exist so long as behavior of human beings is involved.

The present section is intended to deal with the markets in which the farmer appears as a buyer and those in which he appears as a seller. It will refer to the situation of both an industrialized country and a society where industrialization is yet to occur.

THE FARMER AS A BUYER

It has been shown by purely theoretical reasoning that *price* is higher and the *scale of production* smaller under monopolistic competition than under pure competition.⁷² It has also been ascertained by some statistical inquiries and factual studies that monopoly, oligopoly, and monopolistic competition have long prevailed in most industrial markets since concentration of industrial power began to occur. The concentration has been especially accelerated in the last and in the present century in the highly industrialized countries owing to great progress in technology and gigantic expansion of the financial organization. In this respect, the farmer, as any other consumer, would suffer from paying a higher price than if pure competition really existed. But to what extent a farmer suffers depends upon the composition of his purchasing budget. This is because the nature and degree of monopoly are different for different industries. It may be reasonably assumed that a typical farmer in a modern society would have to include the following items of goods and services in his purchase budget: for production purposes — agricultural implements, commercial fertilizer, and railroad services; for consumption purposes — clothing, shoes, and household appliances; for both purposes — automobiles and

⁷² Chamberlin, *Monopolistic Competition*, Chapter 5, "Product Differentiation and the Theory of Value," especially the last section, pp. 113-116.

radios. All these items, except clothing, shoes, and household appliances, are classified, in an empirical study of American industries,⁷³ into groups belonging to "monopolized" markets in which either a few firms control the whole supply or one or a few firms control a major part of the supply. The "competitive" nature of the markets even for items of clothing, shoes, and household appliances is doubtful because elements of monopoly due to location, institutions, and human knowledge or ignorance are never absent in any market for any goods or services.

Thus we may conclude that in the market for industrial goods the farmer has to pay a higher price for the same amount of goods, or get less goods for the same amount of payment, in the present society than in a society where pure or perfect competition could be realized. However, this is only in reference to the short-run market relationship. The long-run technological progress that would have the effect of reducing cost and price and that would benefit the farmer as a consumer is not considered here, because it is assumed given in the present discussion.

The monopolistic element as revealed either in the form of oligopoly or in that of monopolistic competition surely antedated modern capitalistic society. It existed long before modern industrialization was introduced, although its nature has since changed and the extent of it has been accelerated along with the process of industrial concentration. It is obvious that it also exists, at the present time, in those countries where industrialization has made no appreciable start, but contact with other industrialized countries has already begun and economic relations with the latter have tended to be closer than ever.

Historical studies have shown us that it would be a complete mistake to envisage the markets in any period preceding modern capitalistic economy as competitive and absent from the monopolistic element, especially markets under the guild system which were almost entirely monopolistic in nature.

The guild merchant always looked after foreign commerce. It supervised the crafts until they grew powerful enough to form chartered

⁷³ Temporary National Economic Committee, written by Clair Wilcox, *Competition and Monopoly in American Industry*, Monograph No. 21 (Washington, 1940).

organizations of their own. Even then, the craft output for export had to conform to the requirements of those who had a monopoly over exporting, and many of these particular craftsmen were not financially independent of the exporters . . . To keep down the price of food and bolster up that of the articles exchanged for it, the association of merchants [merchant gild] had to prevent the appearance of independent middlemen.⁷⁴

The monopolistic element was revealed in the production of crafts as well as in the marketing of their products. Pirenne has described the medieval craft in a simple statement. "In its essentials, the medieval craft may be defined as an industrial corporation enjoying the monopoly of practising a particular profession, in accordance with regulations sanctioned by public authority."⁷⁵ It may be said that the aim of the craft was to arrive at a "fair price" or a "just price" and to guarantee equality of opportunity, and, therefore, this kind of monopoly is to be distinguished from modern monopoly which aims mainly at maximization of profit. But a moment's consideration makes it evident that the fair price of the medieval craft is in no way different from a price claimed by modern industrialists which consists of "cost of production plus a reasonable margin of profits." Cost of production and "reasonableness" of profit margin, however, are both controversial and ambiguous concepts, and by no means, even if realized, insure the existence of pure or perfect competition or the absence of the monopolistic element. Moreover, entry into business was more restrictive under the medieval guild system than in modern capitalistic society so far as institutional obstacles are concerned.

In the present day, China may serve as another example of a country where industrialization has just begun, although contact with other industrialized countries started almost a century ago. In China, several commodities which constitute the major items in the farmer's budget, especially for cash expenditures, have long been sold under the monopolistic markets. One of the

⁷⁴ Melvin M. Knight, H. E. Barnes, and F. Flügel, *Economic History of Europe* (Boston and New York, 1928), pp. 215, 216.

⁷⁵ Henri Pirenne, *Economic and Social History of Medieval Europe* (New York, 1927), p. 184.

most conspicuous examples is salt. Salt, as one of the necessities, has for centuries been produced and distributed by a small number of privileged merchants who obtained the monopoly of transporting and selling it by paying, usually in advance, a certain amount of cash to the government. These privileged merchants distribute the salt to wholesalers as stipulated in the franchises given by the government. Local grocers in small towns purchase salt from these wholesalers, whose stores are generally located in cities, and then sell it to local people most of whom are farmers. The wholesale price of salt is entirely determined by the privileged merchants, with some modifications by the wholesalers. Local grocers have no voice in the determination of their purchase price, but have great or sole influence in determining their selling price. If it happens that there are only a few grocers in one locality, the selling price is most likely to be the one that can best be explained by the theory of duopoly or oligopoly or monopolistic competition. In whatever form it may be, farmers have to pay a higher price for salt than they would otherwise. Another important item in the cash expenditures of Chinese farmers is that for agricultural implements, most of which are products of local blacksmiths. Prices of these products are in general determined among the local blacksmiths themselves, with reference mainly to the price of pig iron, which is usually monopolized by foundries in cities or big towns. In recent decades, kerosene has become a popular item in the household budgets of Chinese people living in urban as well as in rural areas. Most of the kerosene consumed by Chinese families is a product of the Standard Oil Company of the United States, which has several agents in China. The price of kerosene is determined, as some investigations have shown, almost entirely by the seller under oligopolistic or monopolistic conditions in the form of price leadership.⁷⁶

THE FARMER AS A SELLER

Many economists take a view that perfect market or something approaching it exists in agriculture through the free play

⁷⁶ *Competition and Monopoly in American Industry*, pp. 127-129.

of competitive forces.⁷⁷ They take this view mainly because they think that in agriculture the number of sellers is so large and the unit of enterprise is so small as to exert no perceptible influence on the prices of things sold. It must be admitted that this is one condition for perfect competition, but there are several others which are as essential as this one and which do not exist in the agricultural market. First of all, the number of buyers is often very small, or at least much smaller than that of sellers, so far as a given locality is concerned.⁷⁸ Second, it would be absurd to assume that institutional restraints and locational obstacles are absent in the agricultural market and hence that prices and the mobility of resources are not restricted. Finally, it would also be absurd to assume that farmers have perfect knowledge of the market in which they buy and sell. Therefore, the conclusion is that also in the agricultural market there prevails imperfect competition or "monopsonistic" competition, a term which includes duopsony and oligopsony and more appropriately describes the monopolistic element on the buyer's side.

Under monopsonistic competition prices to farmers are lower, just as under monopolistic competition prices to consumers are higher, than if perfect competition existed. In a highly indus-

⁷⁷ For example, Mason takes the view that "markets in which the demand for the products of an individual firm is perfectly elastic have probably never existed outside of agriculture and, at times, the organized produce and security exchanges." Also he says, "with the decline in the relative importance of agriculture there has declined the importance of purely competitive markets, against this dictum may be set the fact that with the rapid improvement in transportation the area within which these markets might justly be described as purely competitive has increased." It is significant to point out the close bearing of the improvement in transportation on the weakening of the position of local monopoly, but it is highly questionable to regard agricultural market as a purely competitive one. However, Mason is right when he says that "pure or perfect competition is a concept which has never accurately described a large sector of economic reality." See Edward S. Mason, "Industrial Concentration and the Decline of Competition," in *Exploration in Economics* (New York and London, 1936), pp. 434-443, especially p. 436.

⁷⁸ Here a little explanation is required. In a country like China, compared with a country like the United States, the number of buyers (merchants) in the agricultural market would be much greater. But so far as a given locality or a given market area is concerned, within which transport facilities make goods accessible from sellers to buyers, the monopolistic situation would be the same with respect to "number."

trialized country like the United States, it has been shown that imperfect competition prevails in agricultural processing and distributing industries.⁷⁹ Except for the highly perishable farm products, perhaps the most typical marketing channel is "farmer — local assembler — central wholesaler — retailer — consumer." Among the middlemen, the central wholesaler, who is located at the bottleneck of the marketing process, is most likely to both buy and sell under conditions of imperfect competition. A few dominant wholesalers may be, in technical terms, at the same time oligopolists and oligopsonists. On the other hand, the country assembling agency, if it is not integrated with later stages of the marketing process, may sell (to the central wholesaler) under pure competition but buy (from farmers) under imperfectly competitive conditions because of locational factors or local producers' preferences. The monopoly elements that exist in agricultural markets are: market sharing, other non-aggressive price behavior, price leadership, bilateral monopoly, price discrimination, product and service differentiation.⁸⁰

The most typical marketing channel for farm products in the United States (as mentioned above) is also the most popular one for farm products in China, especially for rice, wheat, and soybeans in the southeastern part.⁸¹ The central wholesaler and the local assembler occupy the strategic places in the marketing of grains as well as cotton, which are the most important commodities in the Chinese agricultural market. It is true in China as in the United States that a few dominant wholesalers are at the same time oligopolists and oligopsonists. The only difference is that, while in the United States the whole country is included, in the case of China only a given market area is concerned because of the lack of a national system of transporta-

⁷⁹ Nicholls, *Theoretical Analysis*. For a brief discussion, see the same author's "Imperfect Competition in Agricultural Processing and Distributing Industries," *Canadian Journal of Economics and Political Science*, May 1944.

⁸⁰ Nicholls, "Imperfect Competition," pp. 150-151.

⁸¹ Detailed discussions on the marketing channel of food products in China are given in the following two books: Chang Pei-kang and Chang Chih-i, *The Grain Markets in Chekiang Province*, Monograph No. 14, Institute of Social Sciences, Academia Sinica (Shanghai, 1940; in Chinese); and Chang, *Food Economy*.

tion. The country assembling agency, on the one hand, appears to be one among a fairly large number of competitive sellers to the central wholesalers in a greater market area, but, on the other hand, constitutes with a few others a group of oligopsonists to farmers in a market smaller in size and local in nature. It is at this joint of the market channel that the farmer receives a price lower than it would otherwise be.

It has already been shown that under monopolistic competition the scale of production is smaller than under pure competition. This means, in the industries where monopolistic competition exists, less use of, and hence less demand for, raw materials of which farm products constitute a part. On the other hand, we know also that agricultural production is more steady and more difficult to adjust to industrial fluctuations. The interplay of these two forces — demand and supply — has the effect of depressing the prices of farm products.

It is to be noted that under imperfect competition the farmer as a seller of labor receives a lower wage than if perfect competition existed. It is now generally accepted that "a sloping demand curve [under monopolistic competition] . . . reduces the remuneration of a factor below the value of its marginal product."⁸² Such a factor of production may, among other things, be labor. In the case of labor, Joan Robinson, following Pigou, calls it "exploitation."⁸³ The fundamental cause of exploitation, according to Mrs. Robinson, is the lack of perfect elasticity in the supply of labor or in the demand for commodities.⁸⁴ To whatever causes it may be due, labor, as a factor of production employed in the industries where imperfect competition prevails, receives a lower wage than otherwise. This has the effect of reducing farm wages because of the indirect competition of the lower wages in industry. To what extent the effect exists depends upon the mobility of labor between the

⁸² Chamberlin, *Monopolistic Competition*, p. 187.

⁸³ Chamberlin criticizes Mrs. Robinson for using the Pigovian definition of exploitation, which, to Chamberlin, is appropriate only to conditions of pure competition, but not to the situation where monopolistic competition exists. To Chamberlin, *all* factors are necessarily "exploited" under monopolistic competition. *Monopolistic Competition*, pp. 182-183.

⁸⁴ Robinson, *Economics of Imperfect Competition*, p. 281.

production fields concerned. Another factor which lowers farm wages is also to be noted. It has been stated above that the scale of production in monopolized industries is smaller than under pure competition, and, therefore, less labor is employed by these industries. This means that "labour is turned away to compete with farm labour, reducing farm wages, and by indirect competition turning more farm labourers into renters (thereby raising rents and reducing renters' returns)." ⁸⁵ To what extent this effect operates also depends upon the ease with which labor is transferred from factory back to farm.

⁸⁵ Shepherd, *Agricultural Price Analysis* (1941 edition), p. 394.

CHAPTER III

THEORY OF INDUSTRIALIZATION

A DISCUSSION of the concept and patterns of industrialization is imperative, because the term *industrialization* conveys many different meanings which occasionally cause unnecessary ambiguity. It is not necessary for everyone to agree on one definition or conception of the term in question, but some basic points must be considered and clarified before any definition is attempted. After that, I shall try to explain "why," and to describe "how," industrialization, as a process of economic transformation, has taken place. The "why" problem inevitably involves personal opinion and judgment, and will invite further controversy. The problem will be approached as objectively as possible. The "how" problem is chiefly a descriptive and historical one. Some theories or explanations will be included because any description of a time sequence cannot be very effective without some sort of theory behind it.

A. INDUSTRIALIZATION VS. INDUSTRIAL REVOLUTION

Industrialization may be defined as a process in which changes of a series of strategical production functions¹ are taking place. Such changes may first appear with a production function of an individual firm, and later on spread over the society with such a dominance as to constitute a social production function.² The "strategical" production functions are those

¹ The production function is usually written as $P = f(a, b, c, \dots)$, where P is product and $a, b, c, \dots$ are productive services or factors used in the production. It is also written in the Cobb-Douglas formula; $p = bL^kC^j$ for two dimensions, or $P = b + kL + jC$ for three dimensions. As for the latter, see discussions given by M. Bronfenbrenner in his article "Production Function: Cobb-Douglas, Interfirm, Intrafirm," in *Econometrica*, January 1944.

² A social production function is conceivable only if free competition prevails, under which most related to our present point is the free mobility of factors of production. In view of the actual existence of imperfect competition, the concept of social production function is useful only for theoretical analysis.

the changes of which are generating and determining the changes of other production functions, while the latter may appropriately be termed "induced." From the experience of various industrialized countries, changes of such strategical production functions can be best illustrated in the fields of transportation, power industry, machinery industry, iron and steel industry.

The foregoing definition of industrialization is only a tentative one as conceived by the present writer, and is broader than most definitions or interpretations given by other writers.³ It indicates the characteristic changes in the economic world during the past two centuries, and includes both industrial developments and agricultural reforms. If all production lines — manufacturing and mining as well as agricultural — are classified into capital-goods and consumption-goods industries, it is obvious that those strategical production functions are mostly connected with capital-goods industries. It is also evident that almost all agricultural enterprises and part of the manufacturing industries, such as the textile and the shoe industries, belong in the field of consumption-goods industries. Under this classification, agricultural enterprises would be subject to the influence of the same strategical production functions as would any other consumption-goods industry. It is in this sense that industrialization under our definition would include "industrializing" both manufactures and farms. Referring to the history of the past two centuries, we can see clearly how strategical innovations⁴

³ A definition or interpretation most generally understood is that industrialization stresses the increase of manufacturing and other *secondary* production as compared with agriculture and other *primary* production. See Eugene Staley, *World Economic Development* (Montreal, 1944), p. 5. This interpretation or understanding excludes the case where agriculture, while having been "industrialized," still occupies the predominant place in the whole economic society. The example nearest to this case is that of Denmark.

⁴ Schumpeter defines innovation as the setting up of a new production function. Under this conception, the strategical innovations may be identified with the changes of our strategical production functions. For further interpretation of innovation, the reader is referred to *Business Cycles*, I, 87-102. Black has recently made a valuable analysis on innovations in agriculture, of which some may be taken as strategical (at least to agriculture) and some as induced, according to our classification. See "Factors Conditioning Innovations in Agriculture," *Mechanical Engineering*, March 1945.

have brought into being and intensified a process which we call industrialization. Most conspicuous of these innovations are: the use of railroads and of steel ships and motorization in transport; extended use of the steam engine and electrification in power industry; invention and application of machines to manufacture and agriculture; and the making of machine tools. These strategical innovations or changes of strategical production functions have further intensified the organizational changes accompanying the rise of the modern factory system, marketing structure, and banking institutions. All these changes have been working their way into the production structure of agriculture as well as the manufacturing industry, and thus have essentially characterized, and undoubtedly will continue to characterize, the process of industrialization.

Other writers have arrived at a similar concept of industrialization. Among them Paul M. Sweezy is especially worthy of mention. He defines industrialization as the establishment of new industries, or building new means of production.

If we start [says Sweezy] from an economy which possesses virtually no industry (aside from handicraft) it is apparent that it is capable of undergoing a transition, usually called "industrialization," during which the greater part of its energies are devoted to building new means of production. It may be that establishment of new industries is on such a scale relative to total production that for a time an actual curtailment in the output of consumption goods is required. During a process of industrialization all of what we commonly call the "basic" industries appear as new industries, and their establishment absorbs newly accumulated capital without adding correspondingly to the output of consumption goods.⁵

Sweezy's definition or interpretation is similar to the one used in this book because establishment of new industries or building new means of production is essentially the same as change of production function. Although he did not use a word like "strategical" to limit the process, in so far as he understands "industry" as existing only under the factory system (that is

⁵ Paul M. Sweezy, *Theory of Capitalist Development* (New York, 1942), pp. 218-219.

to say, after the period of handicraft) and also in so far as he emphasizes the capital-goods industries (or what he calls "basic" industries) his conception and interpretation of the process of industrialization would eventually be in agreement with the one used here.

Industrialization has been defined here as a process in which changes of a series of strategical production functions are taking place. It involves those basic changes that accompany the mechanization of an enterprise, the building of a new industry, the opening of a new market, and the exploitation of a new territory. This is, in a way, a process of "deepening" as well as "widening" of capital.⁶ This process raises the productivity per worker in the country and per unit of land in its agriculture. It raises the productivity level of the land. It is in this sense that some writers, such as Condliffe and Rosenstein-Rodan, have considered industrialization as an alternative to emigration for solving the problem of over-population and of raising the national income in those areas which are economically much less developed.⁷ It is also in this sense that industrialization and agrarian reconstruction, especially for those less developed areas, are to be considered fundamentally as the interconnected parts of one problem, although a clear distinction should be

⁶ "The deepening process means that more capital is used per unit of output, while the widening process means that capital formation grows *pari passu* with the increase in the output of final goods." See Alvin H. Hansen, *Fiscal Policy and Business Cycles* (New York, 1941), p. 355.

H. Frankel says: "Under industrialization we understand an increase in the amount of capital equipment and productivity per employed person and variety of goods." See his "Industrialization of Agricultural Countries," *Economic Journal*, June-September 1943, p. 191.

⁷ "Since birth-control," says Condliffe, "as a remedy for over-population in the Far Eastern countries lies so far in the future, and emigration is so little likely to afford any appreciable relief, there remains only the expedient of rapid industrialisation." See J. B. Condliffe, "The Industrial Revolution in the Far East," *Economic Record*, November 1936, p. 191. Rosenstein-Rodan says that "If the principles of international division of labour are to be applied, labour must either be transported towards capital (emigration), or capital must be transported towards labour (industrialisation)." He also states that "industrialisation is the way of achieving a more equal distribution of income between different areas of the world by raising incomes in depressed areas at a higher rate than in the rich areas. The assumptions are that there exists an agrarian excess population." See Rosenstein-Rodan, "Industrialisation of Eastern and South-Eastern Europe," *Economic Journal*, June-September 1943, p. 202.

made between industrialization of agricultural countries and "agrarianization" of industrialized countries.⁸

Industrialization is also a process in which the economic gains of industrial progress, mainly in the form of increasing returns, are continuously created and wholly or partially realized.⁹ As Marshall has interpreted it, increasing return is a relation of quantities, that is, "a relation between a quantity of effort and sacrifice on the one hand, and a quantity of product on the other."¹⁰ In other words, it is a relation between input and output. Also as efficiency is defined as the ratio of output to input, increasing return may be, therefore, viewed as increasing efficiency. Thus Marshall has well defined the Law of Increasing Return as follows: "an increase of labour and capital leads generally to improved organization, which increases the efficiency of the work of labour and capital."¹¹ Increasing return is obtained by the realization either of internal economies, or external economies, or both. Given a state of technology, there is accordingly a scale or range of increasing return for a firm or an industry. A new technology will prolong the scale, or enlarge the range, or create a new scale or range. Therefore, industrialization is, in a way, a process in which scales and ranges of increasing returns are continuously created, and in due time respectively prolonged and enlarged.

But industrialization is more than the creation and realization of increasing returns, for in addition to that, it also lifts the

⁸ Wilhelm Röpke has presented a valuable discussion on this aspect. In an article dealing with the problem of industrialization in agricultural countries, he makes a distinction between the two by saying that while *industrialization* is a phenomenon that is in accordance with the development of the world economy (un phénomène qui ne s'écarter pas de la ligne jusqu'à présent suivie par le développement de l'économie mondiale), agrarianization of industrial countries is a policy reversing the trend of economic evolution and indisputably reactionary (Il s'agit ici d'une véritable rupture de la ligne d'évolution, d'une réaction incontestable). See his article "L'Industrialisation des pays agricoles: problème scientifique," *Revue économique internationale*, July 1938, pp. 117-118."

⁹ Here it is confined only to the economic aspect of industrial progress. Whether from the social aspect industrial progress will benefit workers and people at large, and if it does, to what extent it will benefit them, depends in great measure upon the system of distribution both in goods and in income. Discussion of that is not within the scope of the present essay.

¹⁰ Marshall, *Principles of Economics*, p. 319.

¹¹ Marshall, *Principles of Economics*, p. 318.

margin of diminishing returns. It is generally held that the condition of economic progress in the manufacturing industry is the existence of increasing returns. In agriculture the form of progress is different because there the law of diminishing returns operates. This distinction has long been made and is basically important. But by no means is it as clear cut and as simple as most economists think. First, taking the society as a whole, land is undoubtedly a fixed factor. But to individual farms, land is an expansible factor. The internal economies resulting from the application of modern farm machinery still exist and can be obtained by increasing the size of farm.¹² Secondly, in a highly commercialized agriculture, there are various forms of external economies brought about by the enlarged organization of marketing and purchasing, unknown in a more or less self-sufficient rural community. These external economies are obtainable in different degrees with different agricultural enterprises. Here we need only to recognize their existence. Finally, it should be borne in mind that not all the manufacturing industries are of the category of increasing returns; some of them are subject to the influence of diminishing returns as well.

As theoretically anticipated by Allyn Young, high production per capita is a function of increasing size of "industry" rather than increasing size of "plant."¹³ A careful statistical inquiry has been undertaken by G. T. Jones and Colin Clark, in an attempt to show whether correlation exists between size of plant or firm and net output per worker. The result shows that the

¹² As Harvey W. Peck has well said, "researches in agricultural economics have shown that conditions in the modern dairy industry are such that increasing the amount of land and capital equipment up to a certain extent may increase the relative returns in the physical output of the farm or in money returns. Thus a one-man farm in New York State or New England of fifty or sixty years ago was ideally of from eighty to one hundred acres. But with new mechanical equipment, electric milker, manure spreader, hay loader, tractor, truck, and automobile, the individual farmer may take care of the stock and crops on two hundred to three hundred acres." *Economic Thought and Its Institutional Background* (New York, 1935), p. 160. For a more detailed discussion and factual illustrations, the reader is referred to his article, "The Influence of Agricultural Machinery and the Automobile on Farming Operations," *Quarterly Journal of Economics*, May 1927.

¹³ See Allyn Young, "Increasing Returns and Economic Progress," *Economic Journal*, December 1928.

answer is in the negative.¹⁴ But Jones's examination over a long period of American and British production statistics shows that increases in production per capita in any industry are largely dependent on the relative rate of growth of the industry as a whole.¹⁵ All this is in accordance with Young's statement, although the empirical investigations are in no way complete.

The term *Industrial Revolution*, on the other hand, has come to be a generally accepted designation for a certain period of English economic history. Thus it is more of a historical denotation than of a theoretical conception. It owes its present vogue to its employment by Toynbee as the title of a collection of his lectures, published in 1884, one year after his premature death; and its place in economic literature has been confirmed by its adoption as the title of the elaborate and substantial treatise of a French scholar, Paul Mantoux, twenty-two years later.¹⁶ But the term was not absolutely original with Toynbee. According to Usher, it was first used in 1837 by Blanqui, a French scholar, with the intention of attributing to it an importance coördinate with the French revolution.¹⁷ Yet it was Toynbee's use of it which drove home the idea that the events of the period involved a change so complete and so rapid as to be properly designated "revolution."¹⁸ The period designated by the term *Industrial Revolution* in the economic history of England covers, in the opinion of Toynbee and Mantoux, around 1760 to

¹⁴ A detailed discussion is to be found in Clark, *Conditions of Economic Progress*, pp. 291-312.

¹⁵ G. T. Jones, *Increasing Return* (Cambridge, England, 1933).

¹⁶ Arnold Toynbee, *Lectures on the Industrial Revolution of the Eighteenth Century in England* (London, 1st edition, 1884; new edition, 1908); Mantoux, *The Industrial Revolution in the Eighteenth Century*.

¹⁷ Usher, *The Industrial History of England*, p. 247. But according to Bezanson, the use of the term *Industrial Revolution*, also by a French writer whose name was not given, can be traced back to as early as 1827. See Anna Bezanson, "The Early Use of the Term Industrial Revolution," *Quarterly Journal of Economics*, February 1922, pp. 343-349. It seems that it could be traced even further back. At present, however, we may be satisfied with the fact, as can be indicated by the findings thus far, that the term was most probably first used by a French writer and that its use cannot be earlier than the time of French Revolution in 1789.

¹⁸ Sir William Ashley, *The Economic Organisation of England* (London and New York, new edition, 1937), p. 140.

1820.¹⁹ However, there is no agreement among economic historians as to the exact years the period should cover.²⁰ The disagreement is apprehensible because economic evolution, however revolutionary it may appear, is never sudden. It always occurs gradually. Nor is the term confined only to designating a period of English economic history. It has often been loosely used, especially in recent decades, to describe a period similar to that in England for any country, for instance, the Industrial Revolution of Germany since 1870, of United States since 1880, of Imperial Russia since 1890, and of Japan since the Sino-Japanese War of 1894.

Industrial Revolution as a period as well as a process is so important to the theory of economic transformation that it seems advisable to use more space to explore its nature and characteristics. The lines of thought on the problem may be divided into the following four schools or groups, which are in no way exclusive or exhaustive.

The first group includes those earlier writers, such as Blanqui in France and Gaskell in England, who witnessed the changes as they occurred during the beginning of the period. They were so powerfully impressed by the inventions in the textile industries and the development of the steam engine that they usually referred to the *inventions* as the prime cause of the great changes. The great inventions became more or less completely identified with the Industrial Revolution.

Toynbee and some of his followers constitute another group which has placed more emphasis on changes in economic thought and commercial policy than on changes in industrial organization. "The essence of the Industrial Revolution," said

¹⁹ Toynbee, pp. 64-73. Mantoux, p. 43.

²⁰ For example, Cunningham dated the Industrial Revolution from 1770 to 1840. See Archdeacon Cunningham, *Growth of English Industry and Commerce* (Cambridge, England, 1907), III: 613. Usher, on the other hand, has designated no definite date for the beginning of the Industrial Revolution. It may be reasonably presumed that he and his co-authors have used the decade following the end of the Seven Years' War (1756-1763) more or less as the beginning of the period in question. This is because they have emphasized and mentioned several times that decade, in which the industrial expansion began to become more remarkable. See Bowden, Karpovich, and Usher, *An Economic History of Europe Since 1750*, pp. 105, 109.

Toynbee, "is the substitution of *competition* for the medieval regulations which had previously controlled the production and distribution of wealth."²¹ Thus he looked upon the inventions and the growth of the factory system, which undoubtedly also characterize the revolution, as only incidental to the new outlook in theory and in commercial policy. Concerning this view Usher has made a comment which is worth quoting.

Toynbee's efforts must command much sympathy, for they unquestionably gave wider significance to the movement, but it is unfortunate that so much emphasis was placed on the rise of the Laissez-faire Theory. The events of the last quarter-century have carried us all so far from the older notions of unrestrained individualism that few of us would care to represent the "system of individual freedom" as the foremost feature of the Industrial Revolution.²²

The third group consists of Karl Marx and his followers. In his famous work *Das Kapital*, Marx distinguished the revolution in "modern industry" from that in "manufacture" by saying that "in manufacture the revolution in the mode of production begins with the labour-power, in modern industry it begins with the instruments of labour."²³ It is clear that in interpreting the Industrial Revolution, he laid an emphasis upon the factory system and the organizational change, as he said, "the starting point of Modern Industry is the revolution in the instruments of labour, and this revolution attains its most highly developed form in the organised system of machinery in a factory."²⁴ But he did not neglect in any sense the technical aspect of the process. This can be made very clear by further quoting from him. "Here we see in Manufacture the immediate technical foundation of Modern Industry. Manufacture produced the machinery, by means of which Modern Industry abolished the handicraft and manufacturing systems in those spheres of production that it first seized upon."²⁵ This is because "at a certain stage of

²¹ Toynbee, *Lectures on the Industrial Revolution*, p. 64.

²² Usher, *Industrial History*, p. 250.

²³ Karl Marx, *Capital*, English translation from the 3rd German edition (Chicago, 1909), I, 405.

²⁴ Marx, I, 430.

²⁵ Marx, I, 417.

its development, Modern Industry became technologically incompatible with the basis furnished for it by handicraft and Manufacture.”²⁶ On the whole, we may say, Marx emphasized both changes in productive force (technical changes) and changes in productive relations (organizational changes), and the two are interacting — both destroying and generating — throughout the history of economic evolution. This is an application of the method of dialectics. Therefore, to Marx and his followers, industrial revolution that has brought modern industry into being and growing can be best explained by the action of these two changes and, more important, by their interaction.²⁷

The fourth group is made up of modern writers who hold the view that industrial revolution is only one phase in a vast and complex process that is still going on; the various transformations in that phase were gradual; and its nature and characteristics can be fully understood only by a search into the fundamental causes or factors that are underlying the long process of economic evolution. This group does not belittle the significance of industrial revolution, but only brings it back to its proper place in the history of economic evolution after it has been, for a long time, exaggerated by earlier writers. The present writer shares the opinions of this group. It is difficult to single out the chief members of the modern group, but the views held by the following two economic historians, if put together, may be taken as illustrative of the opinion of this group, although we cannot identify any of the former with the latter.

Shadwell asserted, a long time ago, that the term *Industrial Revolution* is not well chosen. In his opinion, it was originally based on a misreading of the facts, and it tends to perpetuate a narrow and erroneous view. Attention directed too exclusively

²⁶ Marx, I, 418.

²⁷ This is made more clear by quoting a paragraph of his. “The Implements of labour, in the form of machinery, necessitate the substitution of natural forces for human force, and the conscious application of science, instead of rule of thumb. In Manufacture, the organisation of the social labour-process is purely subjective; it is a combination of detail labourers; in its machinery system, Modern Industry has a productive organism that is purely objective, in which the labourer becomes a mere appendage to an already existing material condition of production.” Marx, I, 421.

and superficially to textile industries, and more particularly to weaving, resulted in a conception at once defective and exaggerated. A revolution is an event, but what took place was not an event; it was a large and gradual process of evolution, which involved the conversion of some domestic industries, but went far beyond that.²⁸ Thus he included the period of Industrial Revolution in the long process of industrial evolution, for the reason partially given above and partially stated in the following argument. The period under review represents only a phase in a vast and complex process which is still going on, and the generalizations drawn from particular features of it have a limited application. The essence of industrial evolution is not the substitution of the large for the small industry, or even the supremacy of the machine, but something much larger. It is *the mastery of nature in the service of man*, and for its origin we must go back to the beginnings of science — to the search after knowledge which followed the revival of learning.²⁹ It is also for these reasons that Shadwell used the term *Industrialism* to signify those social and economic conditions which have been brought about by the modern development of manufactures, together with the concomitant “extractive” and transporting industries.³⁰

Usher has contributed greatly to clarifying the nature of the economic transformation as seen in the period of the so-called Industrial Revolution. He has also said that no single formula can adequately describe the complexity of forces and reactions that gave the Industrial Revolution its profound significance. There were changes in the relation between industry and agriculture, readjustments in the textile trades brought about by the rise of the cotton industry, technical developments in the metal industries which gave the whole group of metal trades a more important place in industrial society. None of these transformations was sudden: there were many reciprocal influences, so that particular inventions were at once cause and effect.³¹ Thus

²⁸ Arthur Shadwell, “History of Industrialism,” in *An Encyclopedia of Industrialism*, Nelson’s Encyclopedic Library, pp. 292–293.

²⁹ Shadwell, pp. 295–296.

³⁰ Shadwell, preface, p. vii.

³¹ Usher, *Industrial History*, p. 251.

the main points of Usher's view are that the transformation under inquiry cannot be described or explained by any single factor or theory, and that its process is gradual rather than sudden.

In this book industrialization has been defined with a theoretical conception and Industrial Revolution thought of as a phase of historical development. The two terms cannot be identified with each other, nor can they be taken as mutually exclusive. They are partially overlapping. Under this definition the period of Industrial Revolution is the initial phase of industrialization, considering the world economy as a whole.³² It is to be noted, however, that in that period only England and France were advanced industrial countries. It is also in that sense that the term *Industrial Revolution* can be properly used to signify the beginning stage of industrialization for those countries which are less advanced in economic development.³³

B. GENERATING AND LIMITATIONAL FACTORS IN INDUSTRIAL EVOLUTION

For a long time unsettled controversies have existed in explaining the rise of modern capitalism and the coming of the phase of industrial revolution. Further investigation of these controversies directs us to a study of the theory of economic development which may help build a theory of economic evolution. In pure economic theory, the tradition has been to concentrate study on the dependent variables, such as the prices of goods and of factors of production, assuming that data for their determination are given. In the theory of economic development, the emphasis is laid upon the changes in the data of economic theory, the data that we call independent variables.

³² Schumpeter has identified the first "Kondratieff" or the first long cycle (1787-1842) with the period of Industrial Revolution, the last phase of which includes "railroadization." The second "Kondratieff" is identified with the period of "electrification" and "motorization." See Schumpeter, *Business Cycles*, pp. 252-255. We may say that Industrial Revolution, railroadization, electrification, and motorization are the different phases of the long process of industrialization.

³³ Condliffe has borrowed the term *Industrial Revolution* to signify the industrialization of the Far East. See his article, "The Industrial Revolution in the Far East."

There is a well-known list, suggested by Frank H. Knight, to cover the "factors in regard to which change or the possibility of change must be studied." These factors are the data for economic theory and are the objects of study for the theory of economic development. The list includes the following factors or independent variables.³⁴

1. The population, number and composition.
2. The tastes and dispositions of the people.
3. The amounts and kinds of production capacities in existence, including
 - a) Personal powers
 - b) Material agents
4. The distribution of ownership of these, including all rights of control by persons over persons or things.
5. Geographic distribution of people and things.
6. The state of the arts; the whole situation as to science, education, technology, social organization, etc.

There is no reason to assume that these factors or variables are entirely independent of any change in other factors or variables. In a longer run, these independent variables may also become dependent. Let us take tastes as an example. According to Roll, there are three kinds of changes in tastes or consumers' preferences. The first are "autonomous" changes, the causes of which cannot be easily ascertained; the second are "repercussive" changes, which are themselves the results of changes in population, capital, productivity, and so on; and, finally, there are changes in tastes which are deliberately brought about; they are "induced."³⁵ It is only the first kind of changes that can claim to be independent. It is very difficult to ascertain statistically the proportion of changes in tastes which fall in the first group. But it may be reasonably stated that changes of the second and third groups combined would surpass the first in frequency and in degree. Thus Schumpeter considers it justifiable

³⁴ Knight, *Risk, Uncertainty and Profit*, p. 147. A more detailed discussion will be found in E. Ronald Walker, *From Economic Theory to Policy* (Chicago, 1943), pp. 149-163.

³⁵ Roll, *Elements of Economic Theory*, pp. 217-218.

to "act on the assumption that consumers' initiative in changing their tastes is negligible and that all change in consumers' tastes is incident to, or brought about by, producers' action."³⁶

If this argument is carried too far, it will lead to a situation where none of the factors in economic society can be taken as independent, because all factors are, in one way or another, interdependent and interacting. Thus a point must be found on which to stop and stand. In order to build a theory or a systematic argument to explain economic phenomena so complicated, especially because the complexity increases as the period or process of evolution is further prolonged, the concepts of "partial" interdependence and "relative" continuity³⁷ have to be used instead of the general and the absolute ones. This has already been made clear in the first chapter. It is for this reason that we can still rely on several fundamental factors, with some qualifications, to explain the process of industrial evolution.

Because the nature of the process of industrial evolution is different from, and the period is presumed to be longer than, that used in the theory of economic development, some factors listed by Knight as quoted above have to be reconsidered and reclassified. Factor 2, the tastes and dispositions of people, is to be considered as a dependent variable. Factor 5, geographic distribution of people and things, is to be regrouped into the first and third factors. After this reclassification, the following four fundamental factors are obtained for explaining the process of industrial evolution:

1. Population — number, composition, and geographical distribution
2. Resources or material agents — kinds, amounts, and geographical distribution
3. Social institutions — the distribution of ownership of productive agents, personal and material

✓ ³⁶ Schumpeter, *Business Cycles*, I, 73.

³⁷ Usher has long held a view of "relative continuity" in interpreting historical development. See his *History of Mechanical Inventions* (New York, 1929), p. 6. Black has also, for a long time, maintained a view of "partial or relative dynamics" in explaining the nature of economic society; as he once said: "A purely *static* society would be one in which everything is fixed as to quantity and type, a purely *dynamic* society would be one in which everything is constantly in a state of flux or change. The society in which we live is somewhere between these two extremes." See *Production Economics*, p. 591.

4. Technology — emphasis to be laid on the application of inventions, while conditions of science, education, and social organization are considered outside the scope of present discussion.

In addition to these four, it is necessary to mention another fundamental factor, that is,

5. Entrepreneurship — changing the production function or applying a new production function.

These five factors, to the present writer, are the most important ones in generating and shaping the process of industrial evolution. But their natures and influences are different, and can be further grouped into two classes. I consider entrepreneurship and technology as generating factors; resources, population, and social institutions as limitational factors. They will be discussed in turn, except the factor of social institutions which is considered "given" in the present essay.

GENERATING FACTORS: ENTREPRENEURSHIP AND TECHNOLOGY

Entrepreneurship

The concept of *entrepreneurship* has long been a topic of controversy. It has been defined by one author as the function of "carrying out the innovations."³⁸ It also has been classified by another author as: 1. risk taking; and 2. management, which includes both supervision and coördinating ability.³⁹ The present writer, in an unpublished paper, has interpreted and, to some extent, clarified the function of management as that of "external" and "internal" coördination.⁴⁰ By external coördination is meant that part of the managerial function which determines what sort of contracts should be entered into and which carries out the adjustments to the given constellation of data. In other words, this function is concerned with the allocation of resources along the various lines of investment, with the adjustment of the productive concern to the continuous changes of

³⁸ Schumpeter, *Business Cycles*, I, 102.

³⁹ Kaldor, "The Equilibrium of the Firm," *Economic Journal*, March 1934, pp. 60-76.

⁴⁰ "A Note on the Equilibrium of Firm."

economic data. By internal coördination I mean that part of the managerial function which is concerned with the carrying out of the production (either "make to order" or "make for stock") properly and efficiently according to a predetermined plan.

But what we emphasize here is the "enterprising spirit" which lies behind, and leads onward, the enterprising actions. Sombart has interpreted this spirit as a mental attitude which is dominated by the principles of acquisition, of competition, and of economic rationality.⁴¹ He considers the "enterprising spirit,"⁴² together with "form" (regulation and organization) and "technical methods" as the three basic characteristics that constitute the essence of modern capitalism. Of these three, the aspect which he most strongly emphasizes is that of the enterprising spirit. As he said, "at different times different attitudes toward economic life have prevailed, and that it is the enterprising spirit which created a suitable form for itself and has thus created economic organization."⁴³ This spirit is more than the "motive of maximizing profit" which, together with the motive of maximizing satisfaction, makes a rational "economic man" and constitutes one of the most fundamental assumptions in economic theory. The former is broader because it includes, most important, the spirit or the intention of "enterprising for enterprising itself," in addition to "enterprising for profit."

The enterprising spirit is a fundamental generating factor for the rise and vigorous development of the so-called "commercial capitalism" in the later Middle Ages, the characteristics of which consist of adventurous undertakings in new territories, improvement of navigation, and advance of commercial organization. These commercial changes that have broadened the mar-

⁴¹ See Werner Sombart, "Economic Theory and Economic History," *Economic History Review*, January 1929, pp. 1-19; and also T. Parsons, "Capitalism in Recent German Literature: Sombart and Weber," *Journal of Political Economy*, December 1928, pp. 646-648.

⁴² The two German terms which Sombart uses are *Wirtschaftsgeist* and *Wirtschaftsgesinnung*, and in some cases he simply calls it *der Geist*. It is very difficult to put them properly into an English term. "Enterprising-spirit" may be an acceptable one.

⁴³ Werner Sombart, *Der Moderne Kapitalismus* (Munich and Leipzig, 1928), vol. I, Part I, p. 25.

ket for industries to the greatest extent ever seen in history, together with the mechanical achievements (technological progress) that for the first time made themselves especially apparent at the end of the eighteenth century, have contributed most greatly to making the process of industrial revolution a reality.⁴⁴ Of course one must never fail to recognize that the interplay of several factors is in reality more essential than the acting of any factor alone. But this need not in any sense belittle the primary importance of the enterprising spirit in generating a process that led toward modern capitalism. I used to think that lack of such a spirit in Chinese tradition helped to explain why industrial revolution has not taken place spontaneously within the Chinese economy. In considering this particular problem, one must, of course, also take into account other factors, such as geographical situation, attitude toward scientific research, and government policies. It is to be noted, however, that the enterprising spirit itself is conditioned, or at least influenced, by cultural inheritance. It should also be recognized that only after technological progress has reached a certain stage can the spirit be fully expressed and magnified.

Technology

Technology includes both invention and innovation, the latter meaning application of the former.⁴⁵ Technology as a con-

⁴⁴ Usher has taken the mechanical achievements, the commercial changes, and physiographic factors as three primary causes for industrial revolution. The interplay of the factors is emphasized. See Usher, *Industrial History*, p. 252.

In an initial chapter on the accumulation of capital in the later Middle Ages, Henri Sée urges that international commerce and finance were much more important factors and criticizes Sombart for overstressing the rent on landed property. He follows Pirenne by noting the great role played by the new rich even in earlier times, and chides both Sombart and Bücher for their picture of medieval urban economy as a "closed system." To him, the essential characteristics of present-day (modern) capitalist society are not only the expansion of larger scale international commerce, but also the development of large-scale industry, the triumph of machine process, and the increasingly marked preponderance of great financial powers. For more detailed discussions, see Henri Sée, *Les Origines du Capitalisme Moderne* (Paris, 1926); and for a critical review, see M. M. Knight, "Recent Literature on the Origins of Modern Capitalism," *Quarterly Journal of Economics*, May 1927, pp. 520-533.

⁴⁵ "That to invent a new device, or develop a new method, and then to get it used, are two different steps in human progress, oftentimes with a long lag be-

cept is used here as broader than "technique" because it is incorporated with a process of change. It is also used here to mean both industrial science and technique, and their application. That technology is scientific is a basic characteristic that distinguishes the modern period, the period of the factory system, from that of handicraft. As Sombart has well said,

what characterizes modern technique is that it is scientific. Science and technique are so closely related as to represent the theoretical and practical sides of the same movement. The medieval technique was on the one hand traditional, as received from a master and handed down; on the other hand it was empirical, relying upon experience for instruction and not on objective scientific reasoning. . . . Thus modern technique is both rational and scientific.⁴⁶

In theory technological data may be expressed, for every firm, by the "production function," which links quantities of factors.⁴⁷ Change of technological data, therefore, can best be indicated by change of production function.

Many economists and economic historians have emphasized, and some have made predominant, the factor of technology in explaining industrial evolution and the rise of modern capitalism. It is well known that according to Karl Marx's doctrine of economic determinism political, social, and cultural forms grow out of the economic formation of society which, in turn, is shaped by technological changes.⁴⁸ This may represent the most extreme view of materialism in interpreting history. Werner Sombart has taken technical methods, together with the enterprising spirit and organization, as three characteristics which explain the essence of modern capitalism. Schumpeter's theory

tween, is not an experience peculiar to agriculture. Social scientists often use two terms to designate these steps, 'invention' for the first, and 'innovation' for the second." Black, "Factors Conditioning Innovations in Agriculture," *Mechanical Engineering*, March 1945.

⁴⁶ Parsons, "Capitalism in Recent German Literature," p. 655.

⁴⁷ Schumpeter, *Business Cycles*, I, 38.

⁴⁸ "Technology," says Marx, "discloses man's mode of dealing with nature, the process of production by which he sustains his life, and thereby also lays the mode of formation of his social relations, and of the mental conceptions that flow from them." Marx, I, 406, note 2.

of economic development is built upon "innovation," which is in essence the change of technological data as carried out by the entrepreneur.⁴⁹ Usher places more emphasis on technology than on other factors:

The technological problems with which economic history is concerned present a sharp antithesis to these geographic factors. Changes in technique involve series of individual innovations that are finally embodied in practical accomplishments. These series or sequences of relatively independent inventions are among the most intense manifestations of the dynamic processes of history. . . . Each step in the sequence is a necessary part of the process; each step needs be taken in the given order; consequently these processes of technological development are in form as well as in content the very essence of history.⁵⁰

Thus "the true heroes of economic history are the scientists, the inventors, and the explorers. To them is due the actual transformation of social life."⁵¹

Zweig classifies technological progress under three major heads: progress in productivity, progress in quality, and progress in novelty. The forms of progress in productivity may be expressed in mechanization, rationalization, industrial psychology, and industrial organization.⁵² Progress in productivity is our chief concern, and mechanization will be given more attention than other forms of it.⁵³ As to the relation between technology and productivity, the problems caused by inventions and innovations which raise the marginal products of factors of production in unequal proportions are most interesting. Since, in

⁴⁹ J. A. Schumpeter, *The Theory of Economic Development* (Cambridge, Mass., 1934, translated from the 2d German edition; first German edition, 1911). We must recognize, however, that Schumpeter's innovation is broader than merely technological changes.

⁵⁰ Usher, *History of Mechanical Inventions*, p. 4.

⁵¹ Usher, *Mechanical Inventions*, p. 6.

⁵² Ferdynand Zweig, *Economics and Technology* (London, 1936), p. 38 and p. 52.

⁵³ In this connection, both theoretical and practical discussions will be found in the following two monographs. Lewis L. Lorwin and John M. Blair, *Technology in Our Economy*, TNEC, Monograph No. 22 (Washington, 1941); and John A. Hopkins, *Changing Technology and Employment in Agriculture*, USDA, Bureau of Agricultural Economics (Washington, 1941).

practice, the most important inventions are those which result in an increased or decreased application of machinery, and thus, in an increase or decrease in the proportions of capital used, the most important changes are those caused by inventions which substitute capital for labor and vice versa. The former have been known as "labor-saving," the latter as "capital saving," inventions. Hicks defines them, respectively, as inventions which increase the marginal product of labor more than that of capital and vice versa.⁵⁴ There can be little doubt that the labor-saving invention has been the more frequent in history; and, in early days of industrial revolution, it was the introduction of labor-saving machinery that aroused the antagonism of workers and their sympathizers. Capital-saving inventions seldom occur. In this essay, discussions of technological changes and their effects on industry and agriculture will center around labor-saving inventions.

LIMITATIONAL FACTORS: RESOURCES AND POPULATION

Resources

There is no common understanding as to what constitutes resources. This is mainly because the concept of resources itself is a dynamic and evolutionary one, and hence their content changes from time to time, according to technological development. Very often resources are taken to mean only materials in concrete form, such as agricultural land, forests, and mineral resources. This concept, of course, is too narrow. Important factors such as climate, rainfall, and water power must also be included. One of the classical location theorists, Alfred Weber, classified materials into the "ubiquitous" and the "localized," the former being typified by air and water while the latter includes all other concrete materials.⁵⁵ But water can by no means be taken as ubiquitous; on the contrary, it is rather limited in most cases. Likewise very few materials can be said to be absolutely or permanently localized. Many materials can be sub-

⁵⁴ J. R. Hicks, *Theory of Wages* (London, 1935), p. 121.

⁵⁵ See Alfred Weber, *Theory of the Location of the Industries*, translated from the German by C. J. Friedrich.

stituted for others in one way or another, and some, for which there is at one time no substitute, may be replaced at another time by materials which function just as well. That indigo can be made from coal and that rayon is to some extent a substitute for silk are good examples. Thus, as it is well said by Usher,

it is more significant and more realistic to direct our attention to the degree of localization rather than to attempt classification into the categories ubiquitous and localized materials. The effective task of geographic analysis requires that considerable pains be taken to make a complete survey of the differentiation of resources among the various regions of the world.⁵⁶

And "the outstanding problems of resources differentiation center around the distribution of mineral resources, rainfall and potentialities of water power."⁵⁷ Therefore, the problem of resources must be approached as a dynamic one. This means that technological changes are to be recognized and considered.

But the dynamic method does not exclude the case in which the state of technology is assumed given. To assume a given technology is far different from ignoring technology, as is commonly done in developing the classical location theories. In our analysis, introducing technology is only "setting the stage" which is necessary for the main action. In a period or process where technology is given, some kinds of resources in some regions would be considered as limiting, and hence become a limitational factor for industrial evolution. It has been stated in the preceding chapter that before industrial revolution took place, food resources (including land fertility, climate, and other farming facilities) had been, and for countries where industrialization is yet to begin, still are, the primary limitational factor in determining the patterns of population settlement and the location of economic activities. Since then, food resources have been gradually overshadowed by coal which, in modern economic society, is considered the primary limitational factor. This may partly explain why France, an industrial country sec-

⁵⁶ Usher, *A Dynamic Analysis of the Location of Economic Activity*, p. 23.

⁵⁷ Usher, *Dynamic Analysis*, p. 25.

ond only to England at the end of the eighteenth century and the beginning of the nineteenth, has not been able to become a first-rate industrial power. She lacks the necessary amount of coal to carry through the advanced process of industrialization. Use of hydroelectric power would, of course, compensate in part for the deficiency in coal. But water power itself is highly localized; in places where neither water power nor coal is available, industries of large scale can in no way be established. On the other hand, the United States has made marvelous progress along the lines of mechanical labor-saving devices (labor-saving inventions) not only because of the greater need caused by labor scarcity, but also because no other country in the world is blessed with the same abundance of materials (given the present state of technology) out of which those labor-saving devices can be made and with which they can be operated. The speed of America's progress, therefore, is partly explained by the extent and nature of her need and partly by the favorable combination of resources at her disposal.⁵⁸

As technological changes are introduced, limits as set by resources may be partially lifted, or may be shifted or changed to that of a different category. As a matter of fact, efforts of technology have been usually directed to overcoming the difficulties caused by the shortage or lack of certain materials. Crowded Europe has suffered from an inadequacy of raw materials. Her effort therefore, has to be concentrated upon exploiting to the fullest possible measure the resources which she does possess and upon finding substitutes for those which are lacking and which cannot be readily obtained from the outside. In other words, her effort has to be, in general, centered upon the invention of material-saving devices, as contrasted with the labor-saving devices of the United States. Progress in chemistry in Europe, especially in Germany, serves as a good illustration.⁵⁹

⁵⁸ Erich W. Zimmerman, *World Resources and Industries* (New York and London, 1933), pp. 29-30.

⁵⁹ Germany first made indigo from coal; being cut off from the nitrate of Chile during the War, German chemical manufacturers made nitrogen from the air with the aid of coal and lignite. The blast furnace, the Bessemer converter and the open hearth may be viewed as fuel-saving devices. The Martin brothers of France developed an open-hearth furnace which not only economizes on fuel

Population

Population as a problem may be approached from the viewpoint of size, growth, composition, and change of composition. Here we mean occupational composition. All these aspects can be clearly understood only in terms of relation of population to resources, or, in other words, in terms of per-capita productivity and per-capita income. According to our concept as illustrated above, resources themselves are changing because technological changes are continuously being introduced. One of the most serious defects of the classical population theory in Malthusian tradition is to have neglected the aspect of technological changes. This made the theory unsound, first, in its limiting resources to food alone, and second, in its asserting that the rate of increase for food production is increasingly smaller than the rate of growth for population.

From the point of view of size, we are interested in the ratio of the amount of resources to the size of population. Some writers have identified resources with land, and to them, the ratio is the "man-land ratio."⁶⁰ This may be right in an agricultural society, but it is not so in a regime of modern economy. The size of land alone can by no means fully indicate the amount of resources. This is because in the modern sense and with modern technology, resources consist also of coal, iron ore, oil reserves, and water power, in addition to agricultural land. All these resources must be compared directly with the size of population. In measuring the actual material well-being of a population, we are mainly concerned with the ratio of the amount of national product to the size of population. This is the same thing as the per-capita product. Put product in a common measure and it transforms into the per-capita income. From these measures, we see that population is always the denominator. Thus, given the

but also makes possible the use of scrap. German and other chemists are hard at work trying to produce rubber synthetically." Erich W. Zimmerman, *World Resources*, p. 29.

⁶⁰ "The ultimate elements offered for a scientific study of the evolution and life of human society are Man and Land; given these, there arises at once the necessity of adjustment between them. How much land there is to how many men is the fundamental consideration in the life of any society." W. G. Sumner and A. G. Keller, *The Science of Society* (New Haven, 1927), I, 4.

prospective technological changes and the amount of potential resources, the size of population naturally becomes a limiting factor in determining the ratios which are the best indexes of economic progress. This may explain why the standard of living of peoples in crowded Europe is not so high as that of peoples in the United States, Australia, and New Zealand, although the Industrial Revolution started in Europe. India is unable to achieve a high standard of living for her people for the same reason — the unfavorable ratio of resources to population. China has an amount of strategical resources next only to the United States, but her large population brings the ratio in question down to a low level. The prospect for a high standard of living for her masses is not bright, so far as the present state of technology is concerned.

The rate of population growth, especially in the process of industrialization, is of interest because it fits into our dynamic analysis. From the experience of various industrialized countries, a pattern of the trend of population may be drawn. During the initial stage of industrialization, a rapid decline in the death rate takes place, making possible a huge expansion of population, and is followed in later stages by an accelerating decline of the birth rate, which in more advanced countries has reduced population growth with the imminent prospect of bringing it to an end. The countries of eastern Europe, which are still in the expanding phase of demographic evolution, face ancient and elementary difficulties in providing a minimum living for a rapidly growing population.⁶¹ Japan, also, is still passing through the stage of rapidly increasing population that has been associated everywhere with the introduction of modern industrialism.⁶² On the other hand, in the countries of western Europe the prospect of a stationary or declining population has dissipated fears arising from the earlier phase. Depopulation is now recognized as a greater menace than overpopulation to the industrial nations. Thus, whereas in western Europe the slowing

⁶¹ Frank W. Notestein, *The Future Population of Europe and the Soviet Union* (Geneva, 1944), p. 165.

⁶² G. E. Hubbard and T. E. Gregory, *Eastern Industrialization and Its Effect on the West* (London, 1935), p. 153.

down of the rate of increase of population is causing a relative decline in the industries producing the necessities of life, Japan as well as the countries of eastern Europe are moving in the other direction. They have to make more effort to produce the necessities to provide for their increasing numbers. Experience of this sort will be of great value to a country like China, where industrialization is yet to begin.

As the process of industrialization is started, the occupational shift from agriculture to industry will take place. But there are several factors about the problem that should be clearly recognized and that may serve as a guard against any over-optimism. First, the shift will not be a great one during the early stage of industrialization; at this stage, the labor force in handicrafts will get the preference of being first transferred to modern factories because these workers are more skillful than farm labor and they have locational advantages as far as the cost of labor transfer is concerned. Second, surplus in agricultural labor itself will be increased as mechanization of farming gets under way. The question will then depend upon the speed with which industry absorbs the surplus and the rate at which mechanization of agriculture takes place. Finally, as just stated, in the initial stage of industrialization, population is bound to increase at a greater rate than usual. Industry may not be able to absorb this surplus in addition to that which already exists. This is what occurred in the countries of eastern Europe. The inevitable result has been an increasing pressure of population on the land.⁶³

C. PATTERNS OF INDUSTRIALIZATION

Industrialization may be achieved under different patterns, or types, of forms, according to certain criteria we use for the classification. First of all, according to the amount of initiative taken by government and individual, industrialization may be classified into three types: (1) individual-or-private-initiated; (2) government-initiated; and (3) jointly initiated. Historically, it is very difficult to classify any country as clearly the first or second type, because efforts of both government and individuals were always involved during the beginning of the process. But

⁶³ Notestein, *The Future Population of Europe*, pp. 165-168.

given a certain range of error, as is always present in making any classification, we may be allowed to group England, France, and the United States into the first type, Soviet Russia into the second, and Germany and Japan into the third. The process of industrialization as it occurred in Soviet Russia may be described as a "revolutionary" type, to distinguish it from the "evolutionary" type as seen thus far in other countries. Patterns of industrialization may also be classified according to whether use of machinery and change of organization started from consumption-goods industries or capital-goods industries, and further, if from the former, whether textile or food industries, and if from the latter, whether the iron and steel or the chemical industry. Furthermore, industrialization may be classified according to the means by which capital is raised, whether on the basis of self-sufficiency or by international investment and capital lending.

This section will analyze the patterns of industrialization, as seen thus far from the historical development, under the following three subjects: How was industrialization started? in what sequence and stages has it been performed? and at what speed has it been achieved?

START OF INDUSTRIALIZATION

The start of industrialization may be made through individual initiative, or government initiative, or both. Individual initiative is in accordance with the natural tendency of industrial evolution, a type that first occurred in England and France. That phase of the process has been dubbed "industrial revolution," although actually it is of the most evolutionary type ever found in the history of industrialization. It is more appropriate to call the process started under government initiative a revolution, because it is more sudden and phenomenal. The most typical example is that of Soviet Russia, and to a less extent Germany has followed that pattern since 1870 and Japan since 1868. Here we are more concerned with the evolutionary type, because in it technology is a generating factor and itself is also changing, while with the revolutionary type technology can be taken as almost entirely given, for the reason that it is mostly imported or copied.

In an evolutionary process, the chief generating forces for the start of industrialization are, as discussed in the preceding section, the enterprising spirit and technology. To this no further discussion is to be devoted. But a few remarks seem necessary concerning a statement made by Mrs. Knowles to the effect that personal freedom and English invention are the two great forces that were responsible for the economic development of the nineteenth century.⁶⁴ It is obvious that personal freedom,⁶⁵ which includes freedom to move, freedom to buy and sell, and free choice of occupation, is an important condition for modern economic development characterized by the rise and expansion of modern capitalism. As she points out, this personal freedom, mostly in the form of economic liberty, is largely attributed to the French Revolution so far as Europe is concerned, and may explain in some measure why France and England took a lead in the beginning phase of industrialization.⁶⁶ But I want to stress the point that personal freedom is a *necessary*, but not a *sufficient*, condition for modern industrial development. Its absence indicates the existence of restrictions on economic activity, but its attainment does not mean that it automatically generates and brings about the process of industrialization. In China, the feudal system was abolished more than two thousand years ago and since then the Chinese people have attained personal freedom for economic undertakings. But industrial revolution did not take place in China. In another place Mrs. Knowles says that "personal freedom did not merely mean the abolition of serfdom; it meant the overhauling and liberalizing of gild restriction."⁶⁷ It is in this sense that the Chinese people have

⁶⁴ L. C. A. Knowles, *Economic Development in the Nineteenth Century* (London, 1932), p. 5.

⁶⁵ "The attainment of personal freedom meant the final abolition of serfdom in France in 1789, in Germany and Austria-Hungary between 1806 and 1848, and in Russia between 1861 and 1865. The abolition of serfdom in the British Empire in 1833, in the French dominions in 1848, and in the United States in 1862-3 followed as a matter of course." Knowles, p. 8.

⁶⁶ "It was the French revolutionary ideas of personal freedom that gave the great impetus to the reforms of the period 1806-65 which abolished serfdom in Central and Eastern Europe. It was due to French initiative that the great liberal treaty system of Europe was completed between 1860 and 1870 which meant abolition of so many commercial and colonial restrictions." Knowles, p. 5.

⁶⁷ Knowles, p. 8.

not had complete economic freedom. Yet we wonder if the overhauling and liberalizing of guild restrictions is not itself a result of modern industrial evolution. Moreover, even in modern economic society, no people can enjoy freedom in economic affairs because of the existence of monopolistic as well as monopsonistic restrictions.

From historical records, it may be stated that war has served many countries as a stimulating factor to introduce and hasten the process of industrialization. For example, Germany started industrialization after the Franco-Prussian War of 1870, Imperial Russia after the Russo-Turkish War of 1877, Japan after, first, the Sino-Japanese War of 1894, and later, the Russo-Japanese War of 1904. It is also to be noted that the Napoleonic Wars and the Crimean War respectively contributed greatly to the upswing movement of economic activity during the beginning and the middle of the nineteenth century. After the end of the Civil War in 1865, the United States began to promote industrialization more vigorously, as manifested by adoption of a protective-tariff policy, expansion of the cotton industry, rapid development of railways, extensive use of coal, establishment of the iron and steel industry, and introduction of machinery into agriculture. More obvious is that the prosperous phase of 1920 to 1929 must, to a great extent, be attributed to the stimulation given by World War I.

Explanation of economic expansion in terms of war was advanced most prominently first by Ciriacy Wantrup, and has also been noted by Kondratieff, Wicksell, and recently by Hansen. According to this analysis, the long periods of good times are basically caused by the vast governmental expenditures relating to preparation for war and the war itself; while on the other side, the periods of chronic hard times are caused by the difficult readjustments incident to the sharp curtailment of war expenditures.⁶⁸ Thus, these writers have taken war as a stimulating fac-

⁶⁸ "The best case for this thesis can probably be made out for the first so-called long wave. The long period of the Napoleonic Wars, the vast governmental expenditures which they entailed, and the stimulus which these expenditures gave to the changes in the economic system ushered in by the Industrial Revolution all indicate that the impact of these wars played a very considerable role. Similarly, the sharp curtailment of expenditures, together with the difficult

tor in formulating the movement of long cycles. Among them, Kondratieff takes a more conservative view in estimating the role of war. To him, wars and revolutions can be fitted into the rhythm of the long waves and do not prove to be the forces from which these movements originate, but rather to be one of their symptoms. But once they have occurred, they naturally exercise a potent influence on the pace and direction of economic dynamics.⁶⁹ Hansen, however, takes a more affirmative view, and says, "on balance, it may perhaps be said that, in the 'up-swing' phase of the first so-called long wave, wars occupied a position of major importance, perhaps equal to that of the innovations introduced by the Industrial Revolution."⁷⁰

The influences of war on economic expansion may be approached from three angles. First, war creates demand, and hence stimulates the introduction of new products and the use of substitutes which can be more advantageously produced at home. It stimulates employment, and presents a necessity for introducing technological changes, either labor-saving or material-saving. Finally, it helps wash away some of the institutional obstacles standing in the way of social reform regarding the distribution of income and the ownership of property. Thus, we may safely conclude that war is a stimulating factor for economic expansion, and provides favorable chances, of course for the victorious country only, to start and, if already started, to hasten the process of industrialization.

SEQUENCE AND STAGES OF INDUSTRIALIZATION

Given geographical phenomena, it is technology that brings economic and social changes.⁷¹ In the history of the last two

readjustments to a peacetime basis after the whole of western Europe had for a quarter of a century adjusted itself to war conditions, goes far to explain the difficulties of the long period of chronic hard times from 1815 to the middle forties." Hansen, *Fiscal Policy*, p. 34.

⁶⁹ N. D. Kondratieff, "The Long Waves in Economic Life," *Review of Economic Statistics*, November 1935, pp. 105-115. (Translated from German under the title "Die langen Wellen der Konjunktur," appeared in the *Archiv für Sozialwissenschaft und Sozialpolitik* in 1926, Vol. 56, No. 3, pp. 573-609.)

⁷⁰ Hansen, *Fiscal Policy*, p. 35.

⁷¹ For illustration, it seems necessary to cite some paragraphs from A. P. Usher's *Mechanical Inventions*. "Economic history is deeply concerned with

centuries, we must bear in mind that technological changes themselves were by necessity mutually inducing. They constituted an "orderly sequence" which is by far among the most interesting and significant topics in the dynamic process of history. It should also be recognized that "each step in the sequence is a necessary and *integral* part of the process, and each step must needs be taken in the given order."⁷² The process of industrialization is only another way of stating the sequence of technological changes in modern economic society. Thus, in the evolutionary pattern, the establishment and development of different industries and other production lines also constituted an orderly sequence, which is in essence the main subject of economic history. The sequence as accomplished by revolutionary method, such as that of Soviet Russia, is one of a different category. Our attention will be concentrated mainly on the former, and reference will be made to the latter only when deemed necessary.

In the last two centuries, the technological changes of strategic importance consisted first of those in power and in transport. We recognize the historical significance of the inventions and innovations in the textile industries during the second half of the eighteenth century, the period designated as the beginning of the Industrial Revolution. But it was the invention of the steam engine by James Watt in the period of 1769-1782 and the application of it first to manufacturing industries and later, in the form of the high-pressure engine, to railways that brought the most phenomenal changes ever seen in economic society. The process of "railroadization" that

the development of various associated subjects, but in particular with geography and the technological sciences . . . Geography, broadly conceived, furnishes an account of the environmental factors that inevitably mould social life in many ways. The technological sciences furnish the account of the most important single factor in the active transformation of environment by human activity." (p. 1). "We must have all the elements of the social process clearly presented to the mind; the geographical data bearing mainly upon passive adaptation to environment; the technological data, concerned with the process of active transformation of the environment through human agencies." (p. 2). As to different phases in the process of social change, Usher says "first the technological changes, then the development of the consequences, finally the revision of law or custom." (p. 6).

⁷² Usher, *Mechanical Inventions*, p. 4.

started in the middle of the nineteenth century is most expressive of these changes. The perfection of the turbine water wheel in 1832 opened the way for extensive use of water power. Both hydraulic and steam turbines find their most conspicuous use in large electric generating stations. But the great water powers of the world could not be utilized on a grand scale as long as the transmission of power was dependent upon mechanical connections with the driving shaft of the prime mover. It is at the end of the nineteenth century, when the development of the technique of long-distance transmission of electricity first reached a satisfactory stage, that hydraulic power began to be distributed over large areas and became the cheapest source of power.⁷³ This development of water power exerts an important influence upon the regional distribution of industries and it makes it possible for regions without coal or oil to develop power-using industries on a large scale. Besides functioning as an intermediary for the transmission and distribution of power, the electrical industry also has great and direct influence on the development of communications, such as telephone, telegraph, and the radio-communication system.⁷⁴ The effect of the latter on the sensitiveness of the economic

⁷³ "Important pioneer work on long-distance transmission of direct currents was done by Marcel Deprez early in the decade 1880-1890. After 1885, notable work was done on the technical problems of the alternating current; its production, transmission, and transformation into low-voltage direct current. By 1891, the elements of the new technique were sufficiently established at Niagara Falls. Power House number 1 was begun in 1891; this unit contained 10 turbines of 5,000 horsepower each, operating a two-phase alternating-current generator. This portion of the plant was brought into operation in 1897-8, marking a new stage in the history of the production of power in this country, and roughly contemporaneous with similar development in Europe." Usher, *Mechanical Inventions*, p. 369.

⁷⁴ In the United States, the close coöperation among the General Electric Company, the American Telephone and Telegraph Company, and the Radio Corporation of America since 1920 may be indicative of the influence of the development of the electrical industry on the communication industries. "Following extended negotiations, the Telephone Company and the General Electric Company entered into cross-license arrangements on July 1, 1920, the radio rights so secured by the General Electric Company being passed on to the Radio Corporation of America and the Telephone Company reserving to itself certain rights of the radio field." J. G. Glover and W. B. Cornell, eds., *The Development of American Industries* (New York, 1941; revised edition), p. 841.

structure, especially in regard to marketing and trade, can hardly be exaggerated. The invention of the electric refrigerator and its extensive use for storage should also receive attention. Its effect on marketing and trade is no less important. The invention of the internal combustion engine, resulting in the importance of oil, in the closing decades of the nineteenth century and its wide application to the automobile industry and the farm-machinery industry at the beginning of the present century marks another phase of technological progress and economic development. In the last two decades it made possible also the development of the aircraft industry, which has been greatly expanded by the events of World War II.

Next to power and transport, the machine-tool industry and the iron and steel industry occupy the most strategical position in the process of industrial evolution. The outstanding fact about machine tools is that, by producing an endless number of identical parts, they make possible what is known as "interchangeable manufacture," or what is called in Europe "the American system."⁷⁵ Interchangeable manufacture, in turn, makes possible mass or quantity production. On the other hand, it is the developing technique of the metal trades that opened up new possibilities in quantity production and in the manufacture of interchangeable part mechanism. Until the close of the eighteenth century, the greater part of industrial machinery was made of wood. The last quarter of the eighteenth century is marked by the beginning of a rapid development of methods of refining and working iron, which opened up new uses of iron and steel and soon led to building industrial machinery of iron. The second half of the nineteenth century witnessed great advances in metallurgy and chemistry, such as the Bessemer process for steelmaking announced in 1856, the open-hearth steel furnace devised in 1864, and the basic process of steelmaking introduced by Thomas in 1877. This caused the iron and steel industry to reach its highest stage of development. In 1900, White and Taylor applied alloy steels to high-speed machine tools, which marked another phase in the progress of the machine-tool industry. That the development of

⁷⁵ Glover and Cornell, p. 564.

the machine-tool industry depends upon the development of the iron and steel industry can be easily understood. Interchangeable parts must be assembled in a stable and permanent relationship. The production of interchangeable parts obviously requires a greater degree of precision in manufacture. Thus, quantity production of relatively identical units began in a strict sense with the development of the casting of movable types, which had not reached a higher stage until the end of the last century.⁷⁶ Finally, it is also to be noted that since 1870 steel has come into general use for shipbuilding, and has brought about a revolution in ocean and deep-water transportation.

From the point of view of the whole production structure of a society, the main characteristic of industrialization is the relative increase of capital goods and the relative decrease of consumption goods. In this sense, industrialization may be defined as "capitalization" of production; in other words, pro-

TABLE 1
CONSUMPTION-GOODS AND CAPITAL-GOODS INDUSTRIES IN THE
UNITED STATES, 1850-1927*
(in per cent of total production)

Years	Consumption-goods industries	Capital-goods industries
1850.....	43.5	18.2
1870.....	38.6	23.3
1880.....	43.8	24.7
1890.....	35.6	23.6
1900.....	33.9	28.0
1914.....	31.1	34.3
1925.....	31.1	41.4
1927.....	32.4	39.9

* From Walther Hoffmann, *Stadien und Typen der Industrialisierung: Ein Beitrag zur quantitativen Analyse historischer Wirtschaftsprozesse* (Jena, 1931). Statistics about the United States are borrowed from table on p. 124; statistics about Great Britain are compiled from figures scattered on pp. 100-120.

⁷⁶ It is recommended that the reader refer to Usher's *A History of Mechanical Inventions*, Chapter 12, "Machine Tools and Quantity Production," pp. 319-344.

duction in a more roundabout way. Statistics about changes in the relative place of consumption-goods and capital-goods industries in the United States and Great Britain are cited for illustration in Tables 1 and 2.

TABLE 2
RATIO OF CONSUMPTION-GOODS TO CAPITAL-GOODS
INDUSTRIES IN GREAT BRITAIN, 1812-1924*

Years	Ratio
1812.....	6.5/1
1851.....	4.7/1
1871.....	3.9/1
1901.....	1.7/1
1924.....	1.5/1

* Also from Walther Hoffmann.

The relative increase of capital-goods production as compared to that of consumption-goods during the process of industrialization is clearly shown in these two tables. In the case of Great Britain, for a little more than one century, the ratio of consumption-goods production to capital-goods production has decreased from 6.5/1 in 1812 to 1.5/1 in 1924. The situation in the United States indicates an even more remarkable trend. From 1914 on, the predominance of consumption-goods industries has given way to capital-goods industries. In 1925, the ratio was 4/5 or 0.8/1, which, compared with the ratio of Great Britain (1.5/1 in 1924) shows that the degree of "capitalization" of the whole production structure is deeper in the United States than in Great Britain.

The group of capital-goods industries and that of consumer-goods may be divided into individual ones in order to see the change in each specific industry. Let us take Japan as an example, and from among the consumer-goods industries choose the textile industry and the food industry. Out of the group of capital-goods industries, we shall select the metal, ma-

chine-tool, and chemical industries. The period covers 1923-1936, representing a most important and remarkable stage in the history of Japan's industrialization. See Table 3.

TABLE 3

ANNUAL PERCENTAGES OF INDUSTRIAL PRODUCTION IN JAPAN*

Year	Textile	Food	Metal	Machine-tool	Chemical	Others	Total
1923	45.5	16.8	6.5	6.9	11.8	12.5	100
1929	39.8	14.9	10.7	9.1	14.3	11.2	100
1931	35.7	16.5	10.0	8.8	16.3	12.7	100
1934	32.4	11.5	16.2	12.0	16.8	11.0	100
1936	28.6	10.6	18.0	13.6	18.7	10.6	100

* Source: Department of Commerce and Industry, Japan, *Kojo Tokei Hyo* (Factory Statistics).

It is clear that in a period of a little more than one decade, the percentage of textile in the total production has decreased from 45.5 per cent to 28.6 per cent, and that of food, from 16.8 per cent to 10.6 per cent. In both cases, the amount of decrease was more than one-third during the whole period. In contrast to this, the percentage of metal, machine-tool, and chemical production rose greatly from 1923 to 1936. The metal production increased three times, the machine-tool doubled, and the chemical expanded by one-third. The slight halt and, in some cases, the reverse of the tendency from 1929 to 1931 was due in the main to the World Depression, and may be ignored in a general trend.

The process of industrialization has been divided into three stages, according to the relation of capital-goods production to consumption goods.⁷⁷ These three stages are: (1) predominance of consumption-goods industries; (2) relative increase of capital-goods industries; and (3) balance between consumption-goods and capital-goods industries, with a tendency toward the predominance of capital-goods industries. Hoffmann, from a statistical survey of various industrialized countries, came

⁷⁷ Walther Hoffmann, *Stadien und Typen der Industrialisierung* (Jena, 1931), p. 95.

to the conclusion that the ratios of consumption-goods industries to capital-goods industries in terms of the value of production may be stated in such a way as to correspond to these three stages: ⁷⁸

(1) in the first stage, the ratio was $5 + 1/1$; (2) in the second stage, the ratio was $2 + 1/1$; and (3) in the third stage, the ratio was $1 + 1/1$. Of course, such a pattern of industrial development is confined only to the evolutionary type. In a more radical or revolutionary type, the order of development is not necessarily the same, and can be entirely reversed by government planning. The process of industrialization as revealed and carried out in the three Five-Year Plans of Soviet Russia may serve as a good example. ⁷⁹

GROSS OUTPUT OF INDUSTRY
(in billions of rubles of 1926-27 price level)

	1913	1928	1932	1937	1940	1941	1942
All Industries	16.2	18.3	43.3	95.5	137.5	162.0	180.0
Output of Producers' Goods	5.4	6.0	23.1	55.2	83.9	103.6	112.0
Output of Consumers' Goods	10.8	12.3	20.2	40.3	53.6	58.4	68.0
Percentage Producers' Goods of total	33.3	32.8	53.3	57.8	61.0	63.9	62.0
Percentage Consumers' Goods of total	66.7	67.2	46.7	42.2	39.0	36.1	37.8
Ratio of Consumers' Goods to Producers' Goods	2.0/1	2.3/1	.88/1	.72/1	.64/1	.56/1	.61/1

⁷⁸ Hoffmann, p. 124, Table about "Grossenverhältnisse der Industrieabteilungen in den drei Stadien der Industrialisierung."

⁷⁹ The first Five-Year Plan covered the period of 1929-1932, the second 1933-1937, and the third 1938-1942. The total gross output of industry increased from 1928 to 1940 by 7.5 times, of which the output of producers'-goods industries increased 14 fold, while that of consumers'-goods only 4.3 fold. Effort in the First Plan period was entirely devoted to building and expanding capital-goods industries, whereas the production of consumption-goods was not only prevented from increasing but in some cases even decreased in order to give the former the priority for factors of production. For instance, the production of the cotton and woolen industries was less in 1932 than in 1928. It is in the Second Plan period that consumers'-goods industries received the encouragement to increase their production, but the rate was not so great as that of producers'-goods industries. The following table may be illustrative of the problem in hand. Figures are based upon those used by A. Yugow in his *Russia's Economic Front for War and Peace: An Appraisal of the Three-Five-Year Plans* (New York and London, 1942), Table 1, p. 14. Some of them have been re-calculated by the present writer.

In a purely evolutionary process of industrialization, the points we are most interested in are with what industries the process has started and what has caused the turn from a predominance of consumption-goods industries to that of capital-goods industries. It has been shown by many writers that industrialization of most countries started with textile industries, and only a few with food industries.⁸⁰

The fact that industrialization started often with textiles may be explained by the following reasons.⁸¹ First, the elasticity of demand for clothing is greater than that for food, although both of them are inelastic (less than unity) in the modern concept. In the early period of industrialization, products of groups other than clothing and food were less known either owing to technical impossibility or because demand for them had not been created. Thus, the textiles, either cotton, silk, or wool, which had long been the backbone of domestic industries, or industries under the "merchant-employer system,"⁸² had the privilege and a more favorable chance of being the first to undergo the process of industrial transformation. Secondly, from the location point of view, food crops are, to a large extent, ubiquitous, while cotton, silk, and wool are mostly localized. Trade of

⁸⁰ For factual description, see Hoffmann, pp. 82-94. Countries that started with food industries are Holland, Denmark, New Zealand, and some in South America.

⁸¹ The present writer should here acknowledge his indebtedness to his friend, Pao-an Wu, for a discussion which led to the present statement.

⁸² This is a term which was suggested and first used by Fang. As to a detailed analysis of this system and the relative importance of the textiles in the manufactures, the reader is referred to H. D. Fang, *Triumph of Factory System in England* (Tientsin, China, 1930), first four chapters. Another important analysis of the domestic system may be found in George Unwin's *Industrial Organization in the Sixteenth and Seventeenth Centuries* (Oxford, 1904). The reader is to be aware of the strong influence that Unwin receives from Bücher's stage theory of economic development. A typical example is given in this sentence: "Just as the rise of the handicrafts is associated with the subordination of the village to the larger economic unity represented by the town, so the appearance of the domestic system was part of a later development by which the town was subordinated to the still larger economic unity of the nation at large." *Ibid.*, p. 4. It is quite questionable whether the handicraft system and the domestic system can be treated as two distinctive and successive stages in the historical development of industry. Even more controversial is the thesis that the economic development follows the path of village, town, national, and international economy.

localized products is bound to be more frequent, and its amount greater. It need not be said that trade gives stimulation to production. Also, the mobility of textile goods is much higher than that of food products because of a lesser extent of bulkiness and perishability. The mobility of the latter was very limited before modern storage and the refrigeration system came into use. Finally, from the technical point of view, the textile industries require more skill in production, and hence need labor training more than many other industries. The textile industries need laborers not only of greater skill, but also in a larger amount, so far as the internal production structure is concerned. Such a technical requirement gives the textiles an advantage, and at the same time creates a necessity that labor surplus in rural areas during the initial period of industrialization be absorbed. Furthermore, the textile industries, at least compared with food industries, are more subject to specialization, and hence to concentration, which means large production in one process. This further indicates that they are more suitable for modern organization. The mechanical inventions in the textiles, which themselves have been conditioned by the demand and economic situation, have made it possible for the textile industries to expand and develop.

The turn from a predominance of consumption-goods industries to that of capital-goods industries was not a sudden one. It is further to be recognized that not every country can have such a turn, or reach a stage in which capital-goods industries are predominant. In the 1920's some countries had already reached such a stage, while others remained consumption-goods producers. Table 4 shows the ratio of consumption-goods industries to capital-goods industries in terms of output following World War I, a period considered as the third or higher stage of industrialization. In the years under consideration, only the United States reached the stage of capital-goods predominance. Switzerland, Germany, Belgium, and Sweden reached a state of balance between capital-goods and consumption-goods production. France and Great Britain, although they were the leaders in industrial revolution, had not yet arrived at the stage of capital-goods predominance.

TABLE 4

RATIO OF CONSUMPTION-GOODS INDUSTRIES TO
CAPITAL-GOODS INDUSTRIES IN OUTPUT (A)*

Country	Year	Ratio (A)
France.....	1921	1.5/1
Great Britain.....	1924	1.5/1
Switzerland.....	1923	1.3/1
	1929	1.0/1
Germany.....	1925	1.1/1
Belgium.....	1926	1.1/1
Sweden.....	1926	1.1/1
United States.....	1925	0.8/1
	1927	0.8/1

* From Hoffmann, pp. 118-119.

Besides resources, foreign market may also be considered as a determining factor. Table 5 shows the ratio of the consumption-goods export to that of capital-goods in these same countries in 1926.

It is clear that there is a close relation between the ratio of

TABLE 5

RATIO OF CONSUMPTION-GOODS EXPORT TO
CAPITAL-GOODS EXPORT IN 1926 (B)*

Country	Percentage of total export	Ratio (B)	Ratio (A)†
France.....	61%	2.6/1	1.5/1
Great Britain.....	70	1.9/1	1.5/1
Switzerland.....	66	2.7/1	1.2/1
Germany.....	61	0.7/1	1.1/1
Belgium.....	62	1.1/1	1.1/1
Sweden.....	33	0.4/1	1.1/1
United States.....	34	0.8/1	0.8/1

* From Hoffmann, p. 172. Export of agricultural products was not included.

† From Table 4.

consumption-goods production to capital-goods production (A) and the ratio of consumption-goods export to capital-goods export (B). The higher the former, the higher the latter. But it is not certain that the ratio in export is the cause while the ratio in production is the result; it may be vice versa. Because further statistical evidence is lacking, it can be assumed that they are mutually influenced. It is also evident that there is some relation between the percentage of manufactured goods in the total export and the ratio of consumption-goods to capital-goods export — the higher the former, the higher the latter. But this relationship cannot be positively ascertained because it has been shown historically that, while the ratio in question has been lowered with no exception in every country, the percentage of manufactured goods in total export was decreased from 83 per cent in 1871 to 70 per cent in 1926 for Great Britain, was increased from 44 per cent in 1850 to 62 per cent in 1926 for Belgium, from 17 per cent in 1881 to 34 per cent in 1926 for the United States and from 43 per cent in 1895 to 61 per cent in 1926, for Germany, and remained almost unchanged from 1865 to 1926 for France and from 1895 to 1926 for Switzerland.⁸³

SPEED OF INDUSTRIALIZATION

The speed of industrialization has been a problem very difficult to approach because the concept of speed is not clear and there is yet no common and satisfactory measure of it. Production indexes are very often used as the measure, but the choice of base years and of weights presents almost insurmountable difficulties. Moreover, the construction of production indexes is based upon two fundamental assumptions,⁸⁴ and hence the validity of using them depends basically upon the degree to which these assumptions meet the realistic situations. It is first assumed that the contribution of each industry to the total utility of the commodities produced by the community is in propor-

⁸³ Hoffmann, p. 172.

⁸⁴ For a more detailed discussion, see Arthur F. Burns, "The Measurement of the Physical Volume of Production," *Quarterly Journal of Economics*, February 1930; and Edwin Frickey, "Some Aspects of the Problem of Measuring Historical Changes in the Physical Volume of Production," in *Exploration in Economics* (New York and London, 1936), pp. 477-479.

tion to the "net value product" of the industry as measured in monetary terms, that is, the value which that industry adds to the materials and supplies which it works up. It is further assumed that the net product in the utility sense per unit of "physical" product, for example, ton, bushel, yard, is for each commodity constant over time. The first assumption would drive us further into the basic question of the measurability of utility in monetary terms as well as the possibility of comparing the utility between different products. Considering the nature of our work, we have to stop here and assume that it is so given. As to the second assumption, it has been generally recognized that theoretically adjustment ought to be made in the physical quantity statistics for changes in quality of product. But in practice, no satisfactory technique for such adjustment has been developed up to the present. Failure to express the qualitative side of the technological changes involved in an evolutionary process is an inherent defect and hence a serious limitation to the method of quantitative approach.

Despite all the defects inherent in production indexes, there is, however, no better alternative presented for measuring the change of production. In using production indexes one more qualification must be pointed out. As Burns has well said, no one with even an elementary knowledge of the history of basic commodities can doubt that there has been, generally, a secular advance in their quality. Accordingly, a considerable number of the production series have a "downward growth bias" on this score.⁸⁵

Table 6 shows the average annual rate of growth of industrial production for different countries in the process of industrialization. The rate is in turn based upon the production index of industry as used by some statisticians and historians. Because of differences in the length of the periods covered and the base years used, a comparison between different countries seems unwarranted. However, it is quite obvious that so far as can be shown by the average annual rate of growth of industrial production, the speed of industrialization of Soviet Russia is the

⁸⁵ See Arthur F. Burns, *Production Trends in the United States Since 1870* (New York, 1934), p. 26.

greatest, that of Canada and the United States next, of New Zealand and Australia third, and of Great Britain and France the slowest. This leads to the conclusion that the countries in which industrialization started the latest are, in general, those in which the speed is the greatest. This is so because countries beginning the process of industrialization later usually have greater advantages of introducing the most up-to-date technology.

TABLE 6

AVERAGE ANNUAL RATE OF GROWTH OF INDUSTRIAL PRODUCTION*

Country	Period	Number of years	Production index	Rate (per cent)
Great Britain.....	1812-1907	95	100-1010	2.5
	1907-1924	27	100- 160	1.0
	1812-1924	112	100-1610	2.5
France.....	1812-1911	99	100- 580	1.8
United States.....	1849-1869	20	100- 242	4.5
	1869-1909	40	100- 688	4.9
	1909-1929	20	100- 264	5.0
	1849-1929	80	100-4360	4.8
• Canada.....	1871-1911	40	100- 940	5.8
	1911-1927	16	100- 179	3.7
	1871-1927	56	100-1683	5.2
New Zealand.....	1906-1927	21	100- 220	3.8
Australia.....	1907-1924	17	100- 184	3.7
Soviet Russia.....	1913-1940	27	100- 850	8.3
	1928-1940	12	100- 750	18.3

* The production index for Soviet Russia is based upon the data used by Yugow in *Russia's Economic Front for War and Peace* (New York and London, 1942), p. 14; that for other countries upon the data used by Hoffmann, p. 173.

The characteristics of industrialization can be only partially expressed in the expansion of the manufacturing industries. The expansion of other fields of production, especially those which are considered strategical, such as mining and transportation, should receive equal, if not more, attention. In Table 7 the average annual rate of growth is given for different strategi-

cal fields of production in the United States, to show the speed with which these fields have been expanding during the process of industrialization. The annual rate of growth for population and total production is also given.

TABLE 7

AVERAGE ANNUAL RATE OF GROWTH IN DIFFERENT STRATEGICAL
FIELDS OF PRODUCTION IN THE UNITED STATES

Index*	Period covered	Annual rate of growth
Population	1870-1930	1.9
Total Production:		
Frickey	1866-1914	5.3
Day-Persons	1870-1930	3.7
Warren-Pearson	1870-1930	3.8
Manufacturing:		
Our Index	1849-1929	4.8
Frickey	1866-1914	4.8
Day-Persons	1870-1930	4.3
Mining†	1870-1930	5.7
Construction		
(Building Permits)	1874-1929	4.2
Transportation & Communication		
Frickey	1866-1914	5.8
Trade		
(Deflated Clearings)	1870-1929	5.2

* The Frickey indexes are from Edwin Frickey, *Economic Fluctuations in the United States* (Cambridge, Mass., 1942), p. 198, Table 9. The several indexes referred to as the Day-Persons indexes were constructed by E. E. Day, W. M. Persons, and others; see W. M. Persons, *Forecasting Business Cycles* (New York, 1931), Chapter 11, and references cited there. All other indexes are from Burns, *Production Trends*, p. 236, Table 41, and for references, see footnote on pp. 262-264. It is interesting to note that the three figures on manufacturing agree quite well with one another.

† As to the annual rate of growth for mining, the three figures based respectively upon the three production indexes in mining by Day-Persons, Snyder, and Warren-Pearson in the period of 1870 to 1930 are exactly the same.

It is clearly shown in the table that the annual rate of growth is greater in the fields of mining, transportation, and trade than in manufacturing during the most phenomenal period of industrialization in the United States. This fact is in accord with the concept of industrialization as used in this essay. Both the con-

cept and the fact indicate the significance of the changes in the strategical fields of production to which only part of the manufacturing industries belong.

Another measure of the speed of industrialization is the rate of increase of industrial productivity. Because of limitations in statistical information, we have to confine our study to the situation in the United States and a comparison of it with that of Great Britain. By combining the indexes as constructed by Ezekiel, Douglas, Weintraub, and the *Survey of Current Business*, the real output per worker-hour in the manufacturing industry in the United States is shown in Table 8. The rate of

TABLE 8
REAL OUTPUT PER WORKER-HOUR IN THE MANUFACTURING
INDUSTRY IN THE UNITED STATES
(1920 = 100)

Year	Index*	Year	Index	Year	Index	Year	Index
1870	49.0	1906	90.0	1917	94.0	1928	144.0
1880	57.0	1907	88.0	1918	92.0	1929	146.2
1890	71.0	1908	83.5	1919	94.0	1930	143.8
		1909	89.5	1920	100.0	1931	152.0
1899	75.0	1910	89.0	1921	102.5	1932	153.7
1900	72.0	1911	85.0	1922	118.1	1933	169.3
1901	77.5	1912	94.0	1923	120.8	1934	164.1
1902	79.5	1913	97.0	1924	125.8	1935	172.8
1903	78.0	1914	91.5	1925	133.2	1936	178.8
1904	82.0	1915	99.0	1926	135.1	1937†	176.3
1905	89.5	1916	100.0	1927	136.8		

* The indexes quoted here are: Ezekiel 1870-1890, Douglas 1899-1920, Weintraub 1920-1927 *Survey of Current Business* (Linked to Douglas on 1925 Base) 1927-1937. As to their sources and the computation of the index from data published in *Survey of Current Business*, see Clark, *The Conditions of Economic Progress*, pp. 282-284.

† Figure in 1937 represents November only.

increase between 1870 and 1880, as shown in the table, was 17 per cent, between 1880 and 1890, 24 per cent. Since then, there appears to have been some slowing down in the rate of average increase per decade. From 1900 to 1920, a period covering two

decades, there was an increase of only a little over 30 per cent. But from 1920 to 1930 there was an increase of nearly 50 per cent in average production per man-hour, and of 16 per cent in the seven years from 1930 to 1937. The irregularity of the increase is remarkable and may reveal the tempo of technological progress and the cyclical fluctuations as caused by production adjustments.

In order to make a comparison of the United States with Great Britain, let us take the cotton industry and pig-iron production as examples. Tables 9 and 10 show differences in the change of the scale of production and of real cost per unit in the two countries.

TABLE 9

INDEX OF OUTPUT AND REAL COST PER UNIT IN COTTON INDUSTRY*

Year	Lancashire		Massachusetts†	
	Output	Real cost	Output	Real cost
1855.....	37.3	111.6	14.4	181
1865.....	...	...	18.1	206
1875.....	58.5	100.0	36.5	148
1885.....	71.9	96.9	48.6	120
1895.....	81.2	96.8	64.4	110
1905.....	82.9	95.6	79.6	102
1914.....	...	...	100.0	100
1910-13.....	100.0	100.0	...	...

* From Clark, tables on pp. 307-308.

† Figures for Massachusetts in 1855 and so on are those in 1854 and so on respectively, except the figure in 1895, which is the average of 1889 and 1899. For convenience, one year's difference is assumed negligible.

In the case of the cotton industry, it is interesting to notice that, in Great Britain, possibilities of cost reduction seem to have been almost exhausted as early as 1885, and indeed since that date real costs have tended to rise slightly in spite of increasing output. On the other hand, in the Massachusetts cotton industry, all possibilities in the way of reducing real cost seem to have been exhausted only by 1892. This may be due to the fact that

industrialization, as revealed in the progress of textiles, started earlier in Great Britain. But the relative expansion of the Massachusetts cotton industry between 1874 and 1898 was about as great as that of the Lancashire cotton industry between 1855 and 1885. Yet the reduction in real cost was much greater in the United States than in Great Britain. The same situation occurs in pig-iron production. The British pig-iron industry be-

TABLE 10
INDEX OF PIG-IRON PRODUCTION AND ITS REAL COST*

Year	Great Britain			United States		
	Output of pig-iron	Output per furnace in blast†	Real cost	Output of pig-iron	Output per furnace†	Real cost
1886-1893	72.1	28.1	101.2	26.7	25.4	125.1
1894-1903	86.5	34.6	98.4	41.1	51.0	125.0
1904-1910	98.6	42.8	102.0	81.2	86.0	117.4
1911-1913	100.0	45.4	100.0	100.0	112.4	100.0

* From Clark, pp. 307-308.

† In thousand tons per day.

tween 1880 and 1913 provided an almost constant return for human endeavor. The American industry, on the other hand, showed a very slow rate of reduction of real costs in the earlier years, rapidly accelerating in the closing period. All this shows that the speed of industrialization, as indicated both in output and in productivity, is greater in the United States than in Great Britain.

In general the speed of industrialization for a country depends upon the following factors. First of all, it depends upon the time or stage of technological development at which the country enters the process of industrialization. The speed is always greater for countries which enter the process at later stages than for those which entered earlier, because the former can adopt the latest technical inventions and the newest type of organization more easily than the latter who have more institu-

tional obstacles so far as the social as well as the economic structure is concerned. Second, government policy also has direct influence on the speed of industrialization. It is very obvious that the speed is greater in the case where government takes the initiative in industrial development. In the third place, the speed depends upon whether the process of industrialization starts with, or whether an emphasis is placed on, the consumption-goods production or the capital-goods production. Because of technical reasons, countries starting with or emphasizing the capital-goods production obtain a greater speed in the economic transformation. Finally, the way in which capital is raised also greatly affects the speed. Capital can be raised either on the basis of self-sufficiency or by borrowing from foreign sources. If foreign capital can be well handled and will do no harm to domestic economy in the future, its utilization is advisable and will make the speed of industrialization much greater.

CHAPTER IV

EFFECTS OF INDUSTRIALIZATION ON AGRICULTURAL PRODUCTION

ACCORDING TO THE CONCEPT of industrialization used here, a study of its effects on agriculture is an inquiry into the effects that technological changes of strategical importance, which have taken place mostly in industry, have had upon agriculture as a field of production. As the preceding chapter indicated, most of the strategical production functions are connected with capital-goods industries, such as power, transport, machine-manufacturing, and machine-tools.

Chapter II considered the interdependence and mutual influence of agriculture and industry on the assumption that a state of technology is given. That serves as a starting point for the discussions in the present chapter as well as in the following ones. In the last chapter, among other factors, technological change was introduced into the process of economic transformation. But it was in the main an analysis of the economic process as a whole, and no special attention was given to any specific field of production. The present chapter will deal with the effects of industrialization on agriculture, considering the latter as a group of enterprises.

A. INDUSTRIAL DEVELOPMENT VS. AGRICULTURAL REFORM

Whether industrial development is the cause of agricultural reform is an old controversy. What has happened in England may be taken as an illustrative case. Long ago, Arthur Young and his associates made the argument that agricultural reform is a sequel to the industrial movement. They witnessed the growth of the factory system, and understood that it was linked with the development of agriculture to which they had devoted

themselves. Since then, many economic historians have favored their view so far as the economic development of England is concerned. Arguments advanced by them may be summarized as follows. On the one hand, it was the demand of consumers that gave a decisive impetus to agricultural production. The coming into existence of manufacturing centers and the growth of the town population opened up for the producer a new market, with ever increasing requirements. The days were past when the harvest from one field went no farther than the next village or borough. The working multitudes in the crowded cities, around the mines, factories, and docks turned to the countryside for food. The farms, in their turn, had to become factories where foodstuffs were produced in large quantities, according to improved methods. The adaptation of agriculture to the needs of an industrialized society resulted from an organic necessity, from an indispensable correlation between interdependent functions.¹

Paul Mantoux may be taken as representative of the group opposed to Young and his associates. In his opinion, Young's argument, satisfactory at first sight, does not account truly for the historical origins of the English agricultural movement.

That movement [said Mantoux], like the disappearance of the yeomanry, became apparent long before the increase of the population due to the modern factory system. As early as the first half of the eighteenth century, about the time of the first experiments that, thirty years later, led up to the invention of the spinning machines, English agriculture entered upon a period of change.²

In another place, he expressed the view that the industrial cities, by their rapid progress, would ruin English agriculture even faster than they had enriched it. He also made the statement that the improvement in stockbreeding, though obviously stimulated by the demand from manufacturing centers, was due, at

¹ Prothero (Lord Ernle), *Pioneers and Progress of English Farming* (London, 1888), p. 65; W. Lecky, *History of England in the Eighteenth Century* (London, 1870-1890), VI, 189-190.

² Paul Mantoux, *The Industrial Revolution in the Eighteenth Century*, p. 161.

first, to entirely different reasons than those of industrial development.³

The present writer is of the opinion that industrial development is a necessary condition for agricultural reform, especially if reform is understood to mean mechanization and large-scale organization. Arguments launched by Arthur Young, Lord Ernle, and others stand in our time as well as in theirs. But it should be recognized that by no means was Mantoux entirely wrong. The controversy was due largely to difference in conception of some basic terms, and difference in point of view in appraising the effect of industrial development. These differences may be analyzed and clarified in three ways.

First of all, it must be admitted that industrial development and agricultural reform are mutually affected and the activities in the two fields are always interdependent. But it is also to be admitted that the influences of the two fields on each other are by no means of the same degree. Before the Industrial Revolution, there were periods in which some reforms in agriculture had facilitated industrial and commercial development. Mantoux pointed out that "the enclosures and the engrossing of farms ultimately resulted in placing at the disposal of industry resources in labour and energy which made it possible for the factory system to develop."⁴ But after the Industrial Revolution, it became obvious that industrial development was exerting far greater influence on agriculture than agriculture was on industry. Mechanization of agriculture could not have taken place had the farm-machinery industry not come into existence to supply the necessary equipment. Large-scale farms could not have been a reality had there not been a modern transportation system brought about by railroadization, motorization, and use of steel ships, as well as by modern storage facilities, devices of sterilization, and refrigeration. Mantoux failed to recognize, or, at least, to emphasize, this point.

³ "The chief cause that had long hindered it, namely, the difficulty of feeding live stock through the winter, had been removed. Less labour is required for the care of cattle and sheep than for the cultivation of most kinds of crops." Paul Mantoux, *ibid.*, p. 168.

⁴ Mantoux, page 188.

In the second place, the controversy was due to whether the emphasis should be placed on the long-run or on the short-run effects of industrial development. Arguments rendered by Prothero and Arthur Young were made mainly from the former point of view. In the long run, progress in agriculture must result from industrial development. On the other hand, Mantoux's pessimistic attitude toward the development of industrial cities — "to ruin English agriculture even faster than it had enriched it" — was based largely on the short-run point of view. Moreover, some effects of industrial development which are unfavorable to agriculture must be considered as a necessary price to be paid for the progress of the whole economy. Much has been said about this in the preceding section.

Finally, failure to recognize the nature and content of farm technology has also contributed to the controversy. According to Hicks's criterion⁵ all kinds of technology may be classified into three groups: labor-saving, capital-saving and neutral. But here only two factors of production are assumed — labor and capital. It is unnecessary to say that this assumption is far from realistic when considering the production field of agriculture. In agriculture, land as a factor of production must be given as much consideration as labor and capital. Considering the role that land plays in characterizing agriculture and distinguishing it from industry, we should give even more weight to that factor of production. It seems legitimate, by use of Hicks's criterion, to classify all kinds of farm technology into land-saving, labor-saving, capital-saving, and any combination of the three factors. But this classification does not reveal fully the characteristics of farm technology. We must single out land as the basic factor of production because in the present economy it is fixed. Any progress in farm technology nowadays must mean a greater productivity in land. This is achieved either by investing more capital, or by employing more labor, or by introducing a new crop, a new breed, or a new rotation system. All this may be generally called "intensive" cultivation, to be distinguished

⁵ The criterion is the manner and the degree in which the marginal productivity of a given factor is affected in comparison with the other given factors. See discussions given in the second section of the preceding chapter.

from "extensive" cultivation, which is to increase the land areas. Among all forms of intensive cultivation, the process of mechanization is to be especially emphasized. That process is labor-saving in nature and, in addition to raising the productivity per *acre*, it increases the productivity per *man-hour*, which is one of the characteristics of industrialization. Thus all kinds of farm technology may be classified into three groups: (1) that which increases only the productivity per acre, such as introduction of a rotation system, of a new breed, or of new crop varieties; (2) that which increases only the productivity per man-hour, such as application of power machines and other forms of farm equipment; (3) that which increases both productivities, such as use of chemical fertilizer, control of plant and livestock diseases and pests, and adoption of new methods for preventing erosion and maintaining soil fertility.⁶

Mantoux borrowed evidence from history to show that some agricultural reforms did take place long before industrial revolution, and some even induced, or made possible, the commercial and industrial development. The examples he used are enclosures and the engrossing of farms in the sixteenth, seventeenth, and eighteenth century; disappearance of yeomanry in the eighteenth century; and the movement of labor from country to town in the periods immediately following industrial revolution.⁷ But agricultural reforms of this sort are basically "organizational," as distinguished from farm technology in its narrow sense. In the opinion of the present writer, organizational reforms are in general the result of technological changes. Although enclosures and the engrossing of farms are a prerequisite for the operation of large-scale farms, to accomplish merely the former does not guarantee the realization of the latter. Something of a more essential and generating nature must be relied upon, and that is technology. Among all forms of farm technology, as we have pointed out, the application of

⁶ For a different classification and a more detailed enumeration of farm technology, see John A. Hopkins, *Changing Technology and Employment in Agriculture*, pp. 6-7.

⁷ Detailed discussions and illustrations are to be found in Mantoux, *The Industrial Revolution*, Chapter 3, "The Redistribution of the Land," pp. 140-190.

power machines and use of chemical fertilizers are most important. These technical improvements are essentially capital-investing and labor-saving. Revealing in one production field the characteristics of modern industrialization, they increase both productivity per acre and productivity per man-hour. It is very obvious that agricultural reforms of this category must presuppose a fair degree of industrial development. Because, after all, it is the various branches of industry that supply the machines, the fertilizers, the power, the storage facilities, and the means of transportation which all are needed for a continuous functioning of modern agriculture.

B. THE FARM AS A PRODUCING UNIT

The second chapter discussed, under static assumptions, the farmer as a producer and his relations with producers in industry and other fields of production. Here the factor of technology will be introduced in order to study its effects on the "farm," which is to be taken as a producing unit, or in theoretical terminology as an individual "firm."

First, let us assume, for the farm in question, that the demand for its product is given and its size in terms of land area is also given. Any technological improvement, accomplished either by applying a power machine, or by using chemical fertilizer, or by employing a new farming method, would give the farm either of two results: increase of total yields, or reduction of total cost. They amount to the same thing: decrease in the average cost per unit of product. This means a shift of the U-shape curve to a lower scale. It would be true either under perfect competition or under monopolistic competition.⁸ Figures 1 and 2, showing respectively the situation of perfect competition and of monopolistic competition, illustrate the case.

Let D represent the demand curve and AC the average cost curve before the technological improvement, D' and A'C' represent respectively the same curve after the introduction of tech-

⁸ For discussion and illustration of the equilibrium situation under both perfect and imperfect or monopolistic competition, see Edward Chamberlin, *The Theory of Monopolistic Competition*, pp. 20-25, pp. 74-81, and Joan Robinson, *Economics of Imperfect Competition*, pp. 54-56, pp. 94-97.

nological improvement. But for the moment, let us forget about the demand curve D' , because we are assuming that demand remains unchanged. Before the technological improvement is introduced, the equilibrium point is P , where the average cost is equal to the price (MP is the price line) which includes a normal profit. After the change is made, the cost curve is shifted downward from the scale of AC to that of $A'C'$. So long as the demand is unchanged and the price remains the same, the farm would acquire an amount of extra profit equal to the rectangle $MPQN$.

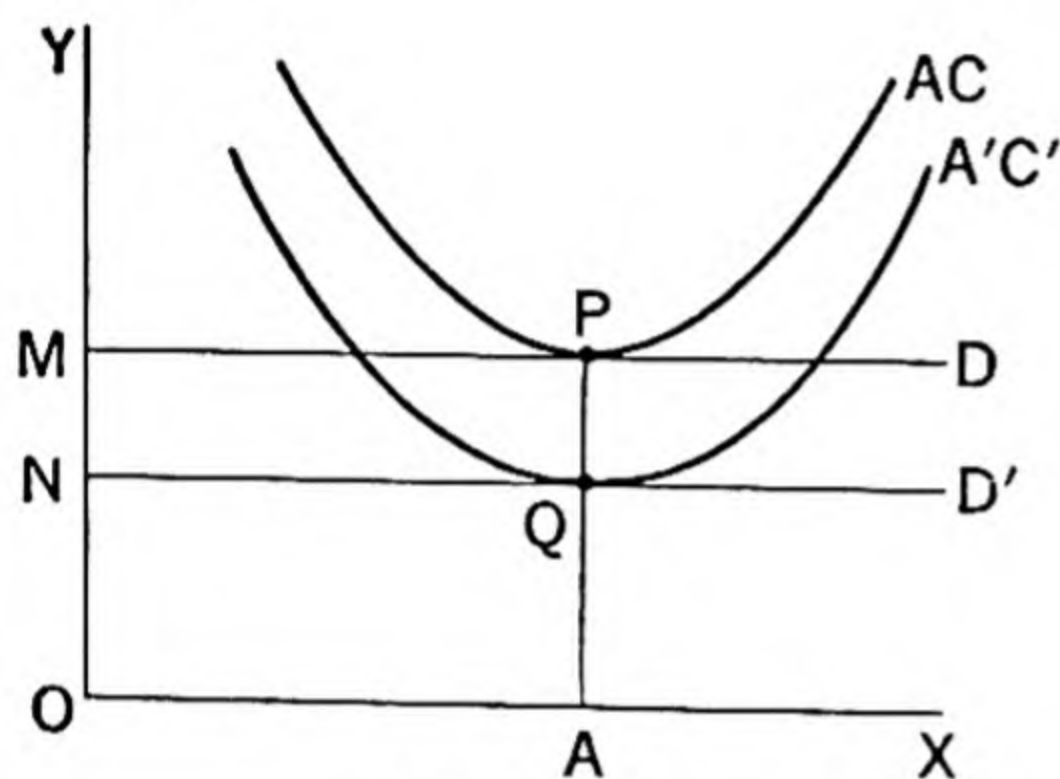


Figure 1

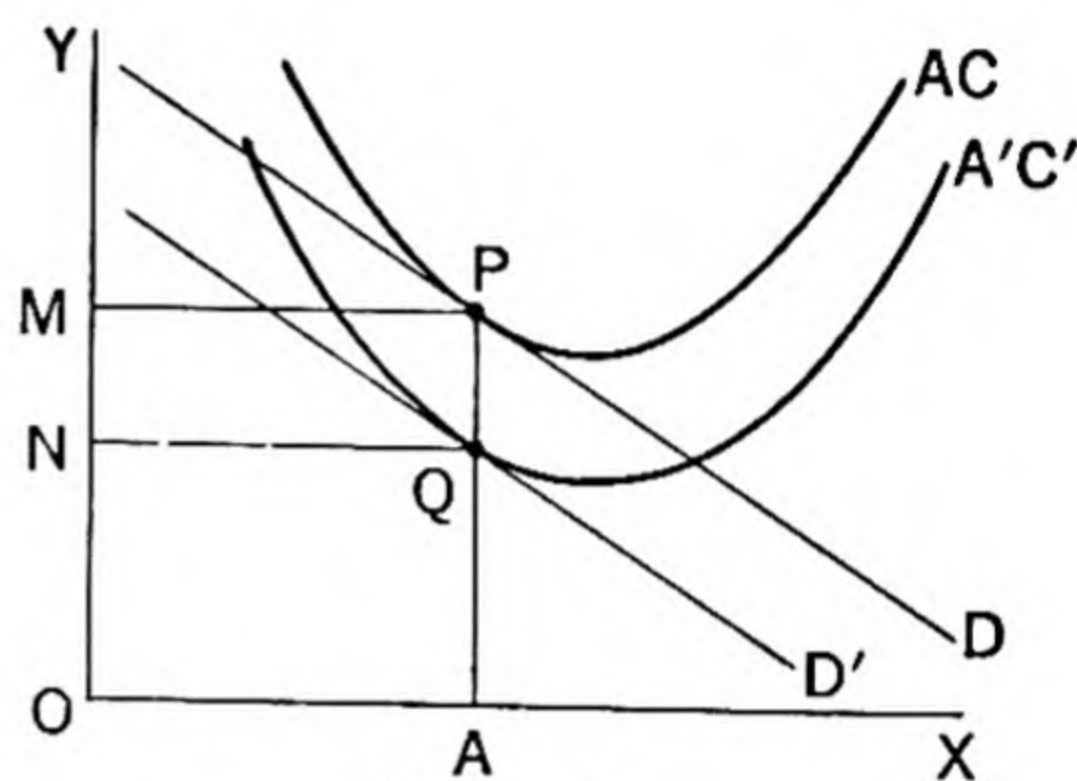


Figure 2

It is to be noted that this extra profit from introducing technological improvement exists only in the short run. In the long run, it will gradually disappear. Under perfect competition, adoption of technological improvement by other farms and thus the competition resulting therefrom will lower the price from AP to AQ and remove the extra profit. Under monopolistic competition, even though the number of farms is small, there is no way on the part of the farm in question to prevent other farms from adopting the same technological improvement. Therefore, the same result, that is to say, the disappearance of extra profit will, sooner or later, take place.

Next, let us still assume that demand is given, but the size of farm can be varied at free will. The technological improvement that the farm will introduce is the one advantage which can be fully exploited only by a greater size of farm as is represented by a greater output.⁹ Under perfect competition, as

⁹ We are assuming that output can be expanded only by increasing the size of farm. In reality, it is quite possible to augment the output without enlarging the farm.

shown in Figure 3, the new cost curve $A'C'$, representing the situation after technological improvement, is not only at a lower scale than the original cost curve AC , but also has its minimum point R farther to the right of point P , where the original equilibrium existed. Under monopolistic competition, as shown in Figure 4, although the equilibrium points P and R

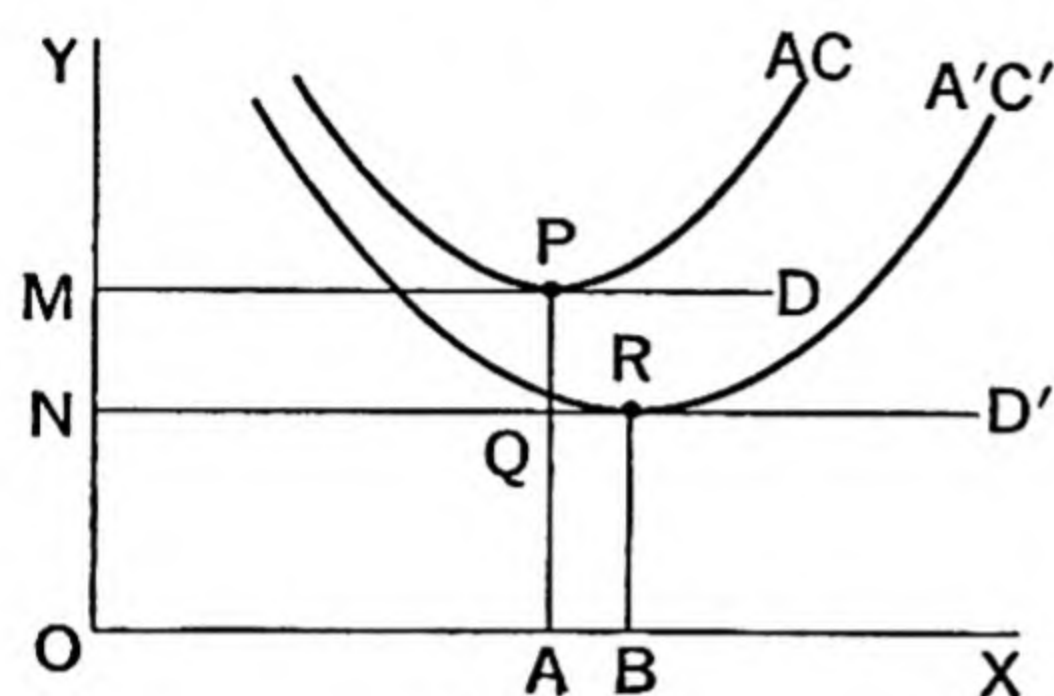


Figure 3

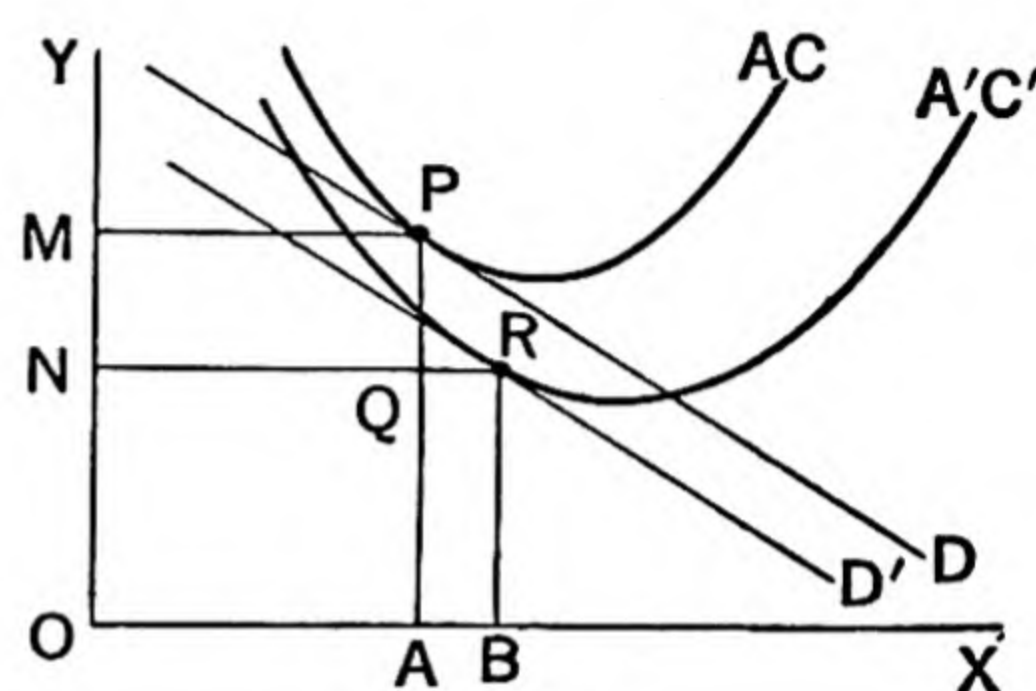


Figure 4

are not at the minimum of the cost curves, it is still evident that R lies farther to the right of P . In both cases, the size of the farm is increased from the output OA to that of OB . If the market price remains at the same level, MP , as will most probably be the case in the early phase of technological change, and if the farm can dispose of the same amount of output as represented by OA because the demand remains unchanged, it will obtain a revenue of $OAPM$ and incur a cost of $OBRN$. The rectangle $MPQN$ represents the extra profit, and the rectangle $ABRQ$ the additional cost, resulting from introducing the technological improvement. The net gain for the farm is thus represented by the amount obtained from deducting $ABRQ$ from $MPQN$.

However, this is also a short-run phenomenon. In the long run, the price will move downward from M to N , and the extra profit will accordingly disappear. This is more likely to occur under perfect competition than under monopolistic competition because in the latter case the producer has more control over the supply. In any event there is a tendency in both cases to reach the new equilibrium point R if the demand is not absolutely inelastic. At the new equilibrium point, the output is in-

creased and the price lowered. The producer has a normal profit and the consumer benefits from a reduced price.

Finally, I shall discuss a case in which the price is held constant while the "product" adjustment is made. Quite often in agriculture, as in industry, a new product may be created because of technological progress. One peculiarity of product variation is that, unlike variation in price, it may, and ordinarily does, involve changes in the cost-of-production curve. Qualitative changes in the product alter the cost of producing it. They also, of course, alter the demand for it. The problem becomes that of selecting the product whose cost and whose market allow the largest total profit, price being given. Another peculi-

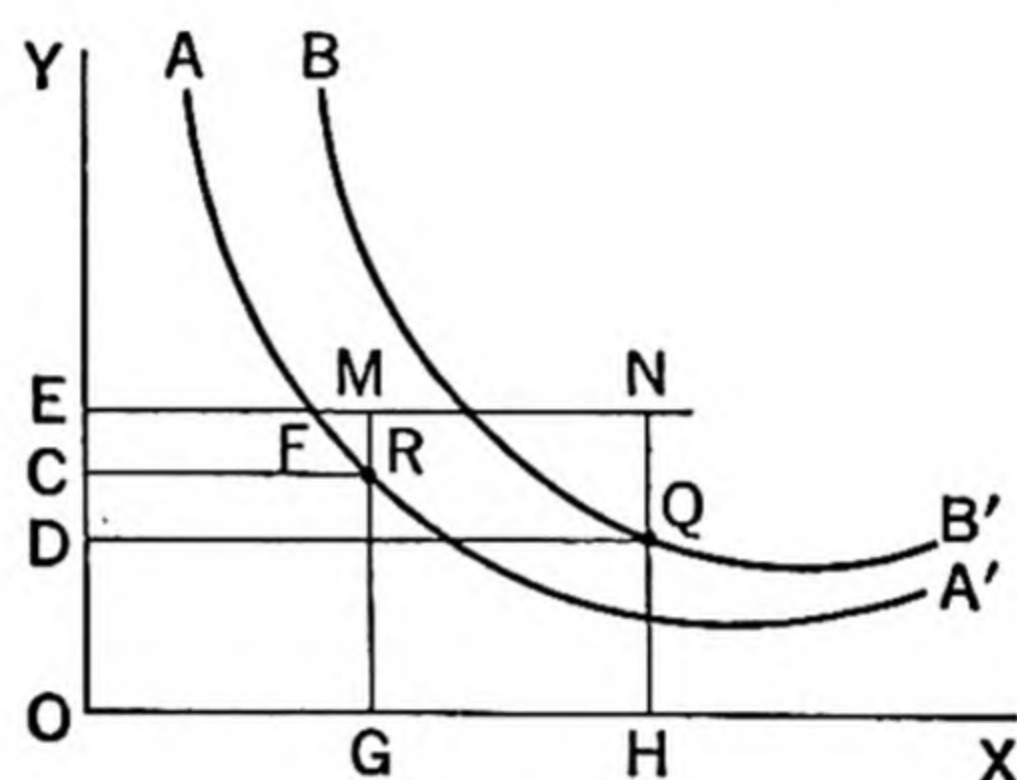


Figure 5

arity is that product variations are in essence qualitative, rather than quantitative; they cannot, therefore, be measured along an axis and displayed in a single diagram. Resort may be had, however, to the somewhat clumsy expedient of imagining a series of diagrams, one for each variety of product.

In Figure 5, let OE be the fixed price.¹⁰ For simplicity, only two varieties of product, which we shall call A and B, are illustrated and superimposed on the same graph. The cost curve for product A is AA' and the amount demanded (at the fixed price OE) is OG. Total profit is CRME and total cost OGRC. For product B the cost curve is BB' and the amount demanded is OH. Total profit is DQNE, total cost OHQD. It should be

¹⁰ The figure and the illustrations are borrowed from Chamberlin, *Theory of Monopolistic Competition*, Figure 11, pp. 78-80.

pointed out that the line EN is not a demand line, indicating indefinitely large demand at the price OE. And it is not possible to move back and forth along the cost curve, say along AA', in order to find the best supply to put upon the market; rather, the movement is from one curve to another, as product changes, the amount which can be sold being rigidly defined for each case. Comparing the two possibilities illustrated, it is evident that B is to be preferred to A. By making similar comparisons between the costs and demands for all possible varieties, the producer may choose the one which seems to him most advantageous. But it must be remarked that, because of the existence of monopolistic situations, the product selected is not necessarily that whose cost of production is the lowest (AA' is lower than BB', yet the latter affords a greater profit); nor is it necessarily the one for which the demand is greatest, for cost of production must be taken into account. Furthermore, for the same reason, the output bears no relation to the most efficient scale of production, revealed by the lowest point on the curve of production cost.

I have considered in turn the adjustments made by the farm on price, size, and product in reaction to the introduction of a given technological change. In reality, the producer often combines any two or all of the three adjustments at one time. That situation is too complicated to be put in a single diagram. At any rate, the theoretical analysis as just presented, however simple it may be, serves as a general background for the factual analysis that will be made later.

To see, from historical and statistical records, how changes in the internal organization of the farm have taken place during the process of industrialization becomes an undertaking of present concern. Here one encounters the difficulty of choosing a typical farm for which records have been kept and of which analysis may be made. This is because, on the one hand, agriculture includes many types of undertaking, and it is impossible in a real society to select a farm which will represent all types. On the other hand, because the process of industrialization is an evolutionary one, a farm that was once considered typical may not be representative in later stages. In order to overcome

this difficulty, it seems necessary and fairly appropriate to borrow from Marshall the concept of "Representative Firm." According to him

the representative firm must be one which has had a fairly long life, and fair success, which is managed with normal ability, and which has normal access to the economies, external and internal, which belong to that aggregate volume of production; account being taken of the class of goods produced, the conditions of marketing them and the economic environment generally . . . Thus a representative firm is in a sense an average firm. But there are many ways in which the term "average" might be interpreted in connection with a business. And a representative firm is that particular sort of average firm, at which we need to look in order to see how far the economies, internal and external, of production on a large scale have extended generally in the industry and country in question.¹¹

Having adopted the concept of Representative Firm, let us return to the discussion of the internal organization of the farm. At the start, one thing that is fundamental to the modern farm must be emphasized: the rise and realization of "enterprising spirit." Before such a spirit penetrated the rural community, most agricultural undertakings were pursued chiefly to earn the family living. The farm undertaken with this aim has been described as "self-sufficing." It pays little attention to the market and sells little thereto. This by no means implies that at the time before modern commercial expansion and industrial revolution took place, there were no farms managed mainly for profit. The commercial farm has concurrently existed with commercial expansion since the late Middle Ages. But popularization of enterprising spirit and formation of the farm characterized by application of machines, discipline of workers, and planning in management are things that happened only after the start of, and along with, the process of industrialization. In the theoretical discussion just presented, it has been assumed that profit making is the only and basic motive. Actually, even in a highly industrialized economy, like that of the United States, the place

¹¹ Marshall, *Principles of Economics*, pp. 317-318.

of the family farm is still of some importance.¹² Our main concern, however, is the transformation of the farm from a subsistence to a modern type — either in a capitalistic or in a socialistic regime. The effects wrought on, and the adjustments made in, the internal organization of a theoretically representative farm are the objects of our further inquiry.

As the process of industrialization is under way, its effects on agriculture are essentially and most remarkably expressed in the change of the demand for farm products. These effects are brought about on the farm through the price system. As was discussed in Chapter II, there are two groups of farm products — food and raw materials — each affected by the general process of industrialization. As to the demand for food products, the income effect of industrial population is divided into two types or, as a matter of historical development, two stages. First, as income rises, the demand for food products, in general, will be increased. Second, as income is further augmented, an increase in demand for better food will take place. So far as individual income groups are concerned, these two types of effects will take place concurrently, but for the economic society as a whole, they will act only in succession. The demand for raw materials will increase in quantity and shift in kinds as industrial expansion is under way. Of what category and magnitude the effects will be depends upon the elasticity of demand for the particular goods in question and the cost structure of producing those goods for whose production the raw materials are destined to be used.

Now, return to our Representative Farm. Assuming that the extensive margin of cultivation has reached its maximum, the farm can meet the change in demand — either increase in

¹² In the United States, the average percentage of total farm products used by the operator's family for all types of farming is 12.7 per cent. The percentage, except that of the self-sufficing farm which is 66.1 per cent, varies from 3.4 per cent for stock ranch to 20.3 per cent for general farming. For the cash grain farm and the animal specialty farm the percentage is 8 per cent; for crop specialty farm, dairy farm, and poultry farm 11 per cent; for cotton farm 15 per cent. From *Fifteenth Census of the United States, 1930, Agriculture*, IV, 891, 913, 930. The census of 1935 has shown that fewer than 1 million of the 6.8 million farms reported hired labor, and only 107,000 reported more than 2 hired workers per farm. See *United States Census of Agriculture, 1935*, vol. III, Chapter 4, Table 9, p. 164.

amount or shift in kinds — only by exploiting the possibilities of raising the intensive margin. This requires the introduction of a new technology. A technological change is theoretically a change in production function. It involves a new combination of factors of production. Thus any technological change would lead to a change in the cost structure of a firm or farm. But a change in cost structure does not necessarily imply that a technological change has taken place. While technological changes are “technical” and “qualitative,” and cannot be expressed in economic terms, such as, for example, prices paid for factors of production, yet whenever a new technological device is introduced, adjustment in the cost structure of a producing unit must be made.

There are three factors of production used by the farm; that is, land, labor, and capital. A farm differs from an industrial firm not only in that it has to base its production structure upon land, but also in that it has been thus far organized around the family labor supply. This is as true of the peasant farm of China or Middle Europe as of the commercial farm prevalent in the United States.¹³ As has been pointed out in Chapter III, industrialization is in a sense a process of “capitalization” — a process of extensively and intensively using capital or widening and deepening the capital. This applies to agriculture as well, only in a less remarkable degree. Thus the chief characteristic of capitalization in agriculture, as revealed, for example, in mechanization of farm operations and utilization of commercial fertilizers, may be stated in this way: It changes the combination of the three factors of production, that is to say, it increases the proportion of capital relative respectively to land and labor.

It is now necessary to make a statistical search to see if the above proposition can be accepted. It has been shown that in the United States the average farm unit in 1929 used about 8 per cent less labor than in 1909. The labor supply has declined, though not very remarkably, with the size of the family, and averaged only 1.33 family workers per farm in 1935, as com-

¹³ For more about the United States, see John A. Hopkins, *Changing Technology and Employment in Agriculture*, Chapter 3, “Some Characteristics of Agriculture That Affect Trends in Employment,” pp. 22–34.

pared to 1.52 in 1909 and 1.35 in 1929. The hired labor per farm remained practically unchanged from 1909 to 1929 at 0.47 to 0.48 workers per farm, and then declined during the depression to 0.38 per farm in 1935.¹⁴ John A. Hopkins has said that the effect of mechanization in agriculture was partly to reduce the number of workers employed in operations like harvesting and seedbed preparation, and partly to lower the number of full workdays between rush seasons for the remaining workers, that is, usually for the farmer himself.¹⁵ This is true with the collective farm (Kolkhoz) under the Soviet Socialist system as well. The mechanization of operations and the introduction of new agricultural methods considerably reduced the need for human labor in almost all the stages of agricultural work. It has been estimated that in Soviet Russia the introduction of tractors, combines, and other agricultural implements into the collective farm has reduced the entire process of production to 10.5 labor days per hectare, while on individual farms, where no such introduction was made, the same operations required 20.8 labor days.¹⁶

C. MECHANIZATION IN AGRICULTURE

Mechanization is a process that characterizes industrialization and has exerted violent influence on industry as well as on agriculture. It has far-reaching effects both on agricultural production and on farm labor. This section is confined to the discussion of its effects on production; those on labor will be analyzed in the next chapter. Before undertaking the main topic, a preliminary discussion of the form of mechanization and the conditions for its introduction seems necessary.

FORM OF MECHANIZATION

Writers have differed as to the exact time when modern machinery came into general use for farm work. Agreement is impossible because different writers have different conceptions of

¹⁴ From WPA N.R.P. Report No. A-8, *Trends in Employment in Agriculture, 1909-36*, prepared by Eldon E. Shaw and John A. Hopkins, Table 1 and Appendix B.

¹⁵ Hopkins, *Changing Technology*, p. 23.

¹⁶ A. Yugow, *Russia's Economic Front for War and Peace*, p. 64.

machinery, and records of the time of its adoption are scarce. In spite of these difficulties, the decade of 1850 may be taken as the period marking the beginning of an appreciable use of farm machinery in the United States.¹⁷ Since then its use has rapidly expanded, as indicated by the following figures which show the increase of the value of the output of agricultural implements and machinery as reported to the Census office of the United States.¹⁸

<i>Year</i>	<i>The Value</i>
1850	\$6,842,611
1860	\$20,831,904
1870	\$42,653,500
1880	\$68,640,486
1890	\$81,271,651
1900	\$101,207,428

It is to be noted that the figures understate the real development, because, on the one hand, the prices of farm machinery have declined to an enormous extent, and on the other hand, the later machines are more efficient, more durable, more readily operated, lighter, and stronger, a fact which cannot be expressed in any degree by quantitative measures.

The form of mechanization in agriculture may be classified as: (1) the adoption of power machines, such as the use of tractors for field motive power; (2) the application of modern transportation means to rural areas, such as the use of automobiles and trucks for purchasing and marketing purposes; and (3) the adoption and development of improved and larger farm implements, such as various kinds of harrows for different tillage purposes and combines for harvesting work. It goes without saying that these three types of mechanization are closely inter-related.

¹⁷ "The year 1850 practically marks the close of the period in which the only farm implements and machinery, other than the wagon, cart, and cotton gin, were those which, for want of a better designation, may be called implements of hand production." See *Twelfth Census of the United States, Agriculture*, I, xxix.

¹⁸ From *Twelfth Census of the United States, Manufactures*, IV, 344.

The United States may be taken as an example of the adoption of power machines. Between 1915 and 1921, the estimated number of farm tractors increased from 25,000 to 350,000.¹⁹ This expansion was chiefly influenced by labor shortage and high prices of farm products during wartime. Sharp drops occurred during the depression of 1921, but this was followed by conditions favorable to adoption during the remainder of the 1920's, as revealed in a generally satisfactory farm income, high prices both for horse feed and for labor, and continued improvement in the tractor. In this period, the most important change occurred with the development of the "all-purpose tractor" which can be used in cultivating row crops as well as in seedbed preparation. Earlier attempts had been made in this direction but a successful tractor of this type did not become generally available until 1924. At about the same time implements especially designed to attach to the tractor were also made available. During the early 1930's sales fell off again and, moreover, the low price of horse feed as compared to tractor fuel resulted in many tractors standing idle for several years. With returning farm prosperity this decline also was followed by record-breaking sales beginning in 1935. Since then the increase in tractor sales has continued, except for a short-run slackening in 1937. Had it not been for the restriction on the production of farm machinery during World War II, the adoption of tractors would have been further expanded.

The application of modern transportation to farm purchasing and marketing is best revealed in the development of the railroad and the expanded use of motor trucks. Again, the situation in the United States provides an illustration. Construction of railways in that country started in the 1830's, but its full development was not accomplished until the middle of the nineteenth century. The peak in railway mileage was attained in

¹⁹ Hopkins, *Changing Technology*, p. 57. The following figures, which show a sharp increase in the use of tractors during the past four decades, were obtained from *Agricultural Statistics*, published by U. S. Department of Agriculture:

1910	1,000 tractors
1920	246,000 "
1930	920,000 "
1940	1,545,000 "

1916, when there were 254,000 miles of railroad. Since then the mileage has declined. In 1930 it was 249,000 miles, and by 1936 it had further decreased to 240,000 miles.²⁰ However, the railroad network of the United States is still one of the densest among the various industrialized countries. Its impact and effects on the transportation of farm products can hardly be exaggerated, especially in considering the bulkiness of grains, fruits, and even animal products, which only railways can bear. Even more remarkable was the increased use of motor trucks by farms during the period from the conclusion of World War I until the depression. The number of motor trucks registered in the United States was 10,000 in 1910, increased to 1,006,082 in 1920, and further increased to 3,647,474 in 1930.²¹ The number owned by farms in 1920 was 140,000, nearly 14 per cent of the total, and in 1930 it rose to 900,000, more than 25 per cent of the total.²² The number of motor trucks used by farms in this prosperous decade was noticeable because it grew at an increasing rate. Since the depression the absolute amount has continued to increase, but the rate has slowed down. In 1936 the total number of motor trucks registered was 4,023,606, and that owned by farms was estimated at only 1,000,000, even in 1939.²³ It should be noted that adoption of motor trucks did not occur uniformly in all areas. Of the vegetable and apple farms surveyed, 80 to 90 per cent of the farmers had trucks in 1936. At the other extreme, trucks were found on only 12 per cent of the cotton-area farms and 18 per cent of the corn-area farms.

Changes and developments in farm implements are too varied to permit any simple and generalized description. The principal trends may be grouped under four headings: (1) increase in capacity of machines for greater size or speed, (2) wider adoption of machines previously available, (3) improvement in efficiency of implements, and (4) development of new imple-

²⁰ D. Philip Locklin, *Economics of Transportation* (Chicago, 1938; revised edition), pp. 42-43.

²¹ Locklin, pp. 750-751.

²² Hopkins, *Changing Technology*, p. 64.

²³ See Locklin and Hopkins.

ments.²⁴ Attention must be given to differences in types of farming and differences in farm areas.

CONDITIONS FOR MECHANIZATION

It is clear that mechanical improvements have greatly strengthened the competitive position of farm implements — tractors and motor trucks — as compared with labor. But mere technological improvements cannot fully explain the degree of change nor the timing of the successive waves in the process of mechanization. The role that economic forces play must also be considered. From the economic point of view, a wide range of choice exists among combinations of the various factors of production. The precise combination that farm operators tend to adopt under a given set of physical conditions and a given state of technological progress depends on the prices of the various factors per unit of use.²⁵ Among the factors of production the available amount of farm land of each grade is relatively fixed. The amount of farm labor employed at any time may be divided into two categories — that supplied by family members and that obtained from outside. Family labor is considered relatively fixed, while hired labor varies from time to time. The total amount is hence variable and determined partly by the price of farm products, and partly by the competitive bids of other industries for the same labor, as well as by the cost of machinery, which is considered its substitute. Therefore, the amount of farm machinery adopted will depend both on its physical performance, and on its price as compared to the price of farm products and that of labor. As these prices change, so will the extent to which machinery is employed.

It is clear that the adoption of machinery is partially determined by the price of labor. But it should be pointed out that machinery is not merely a substitute for labor, but, in some cases, also a substitute for work animals, such as horses, oxen, and mules. The prices of these animals and the cost of feeding

²⁴ For a detailed discussion, see Hopkins, pp. 70–75.

²⁵ For a detailed analysis, the reader is referred to John D. Black, *Production Economics*, Chapter 13, "Individual Differences and Their Combination," pp. 347–380, and Chapter 14, "Capital Goods in Production," pp. 383–414.

them are also competitive with that of machinery and thus are to be taken into account in estimating the extent to which machines are to be adopted.

In this connection, an analytical tool may be used to describe the substitutive relations between any two factors, or any two groups of factors, when either or both of their prices change. This tool is "elasticity of substitution," which has been defined by Mrs. Robinson as "the proportionate change in the ratio of the amounts of the factors employed divided by the proportionate change in the ratio of their prices to which it is due."²⁶ Elasticity of substitution is determined by the technical conditions of production. When the proportions of the factors are rigidly fixed, no change in the ratio of labor to capital (for instance, machinery) can be made, however great the fall in wages, and the elasticity of substitution is zero. If the smallest fall in wages (the cost of capital remaining the same) were to cause the whole output to be produced by labor alone, the elasticity of substitution would be infinite. The actual cases lie between these two extremities. Although the above interpretation of the elasticity of substitution applies only to conditions of perfect competition,²⁷ and to a stationary state, with due modifications it may still be of some use, at least, of some value for reference, even in our evolutionary economy. Industrialization as a process characterized by technological changes has three obvious effects: first, it changes the proportions of the factors; second, it tends to reduce the price of capital; and third, it provides an ever increasingly favorable condition for the sub-

²⁶ Robinson, *Economics of Imperfect Competition*, p. 256.

²⁷ Only under perfect competition will the proportions of the factors always be such that their marginal physical productivities are in the same ratio as their prices. This means that, "if the price of capital remains unchanged and the price of labour falls there will be such a reduction in the amount of capital employed per man as will raise the ratio of the marginal physical productivity of capital to that of labour in the same proportion as the price of labour has been reduced." (Robinson, *Imperfect Competition*, p. 256). Also only under perfect competition can we adopt Mrs. Robinson's equivalent but more fundamental definition for the elasticity of substitution, namely, the proportionate change in the ratio of the amounts of the factors divided by the proportionate change in the ratio of their marginal physical productivities. (Robinson, *ibid.*, Appendix, p. 330, note 2.)

stitution of capital for labor. On the whole, these effects will tend to raise capital's elasticity of substitution. We know that the elasticity of demand for capital will be greater, the greater is the elasticity of substitution.²⁸ In our evolutionary economy, mechanization in agriculture, as characterized by the replacement of labor and working animals by machinery, will go on so long as both the elasticity of demand for capital and its elasticity of substitution tend to be greater.

The close relationship between the prices of farm products, the wages of farm labor, and the prices of farm machinery on the one hand and the domestic sales of tractors on the other is clearly revealed in the cyclical fluctuations from 1910 to 1940 in the United States.²⁹ The prices of farm products and the wages of hired farm labor moved in the same direction during the period. Both of them rose rapidly during World War I and reached the peak in 1920; both fell sharply from 1920 to 1922; both rose again thence up to 1929; both fell sharply again from 1929 to 1932; both rose again thereafter with the only interruption in 1937 and 1938. The only difference to be carefully noted is that the wages were less fluctuating than the prices of farm products and that the latter always took the lead. The prices of farm machinery showed far less fluctuation during the period and, especially after 1930, showed little fluctuation from year to year. Explanation for the difference between the price movement of farm machinery and that of farm products may be found in the essence of the acceleration principle. Discussion of that principle has already been presented in Chapter II. The domestic sales of tractors in the period showed a high positive correlation with the prices of farm products and the wages of farm labor, while a negative one with the prices of farm machinery. Because the price of farm machinery is less fluctuating than the price of both farm products and of farm labor, owing

²⁸ From the conclusion reached by Joan Robinson, which states that "the elasticity of demand for labour will be greater the greater is the elasticity of substitution." See *Imperfect Competition*, p. 257.

²⁹ Statistical data are to be found in publications by U. S. Department of Agriculture, especially *Agricultural Statistics*.

to the operation of the acceleration principle, so the domestic sales of tractors reveal fluctuations of a far greater magnitude. This means that during the prosperous years much more, and during the depression years much less, farm machinery has been adopted than the price movement of farm products alone would indicate. We have seen that after 1930 the prices of farm products fell sharply while those of farm machinery fluctuated little from year to year. In addition to this, there was a large backlog of labor on the farm. It is very clear that under these circumstances, farmers had little incentive to adopt new machinery. It explains why the domestic sales of tractors in the United States dropped in a drastic manner during the depression.

Thus it may be concluded that there are two necessary and most important conditions for introducing machinery into agriculture: The price of farm produce should remain high, and labor should be scarce and costly. In an old country like China, these conditions can come into existence only after industrialization in the field of industry has attained a sufficient degree. Only then will demand for farm products be increased and prices paid for them be higher because of income effect, and labor become relatively costly in agriculture because of transfer into and absorption by industry. The case of the United States, where labor was scarce from the very beginning of colonization, is different. But even there, the situation has changed in recent years. A fair amount of excess population on farms has existed. Black has treated the excess population on farms, together with inadequate demand and low farm prices, as the important factors that account for the relatively slow progress of innovation in agriculture.⁸⁰ In addition to economic factors, some technical and social requirements must also be fulfilled. Most important of them is the size of the farm, which should be large enough to make it economically advantageous to introduce machinery. Thus, theoretically as well as historically, consolidation of farms has become a prerequisite for mechanization in agriculture.

⁸⁰ John D. Black, "Factors Conditioning Innovations in Agriculture," *Mechanical Engineering*, March 1945.

EFFECTS OF MECHANIZATION ON PRODUCTION

Our attention will now be concentrated upon the effect of mechanization upon work animals, upon the rise of productivity per acre and per man-hour, upon the size of farm, and upon the marketing structure.

The displacement of work animals by farm machinery and by modern transportation means can again be studied by taking the United States as an example, where the data are more available. In the United States, the horse is the most important work animal on the farm and the mule ranks second. Displacement of horses by tractors, trucks, and automobiles began after 1915, but did not become pronounced until 1919. In 1916 there were nearly 27 million horses on farms in the United States, of which about 21 million were three or more years old, that is, were of working age. By 1925 the total number of horses was down to 22.3 millions and work horses to 19.9 millions. Subsequently, tractor adoption was speeded up by the appearance of the "all purpose" or row-crop tractor. By 1938, the total number of horses and mules was down to 15.4 millions, and the number of work horses to 13.1 millions.³¹ It has been customary to use this absolute decrease in number of farm work animals as a measure of displacement by machinery. However, a more logical approach is through the change in ratio of work animals to acres of crops. The difference between the actual number of work horses on farms in the United States in 1938 and the number that would have been required at the rate of one horse to 16.5 acres of crop was approximately 7.6 millions.³² This amount

³¹ From U. S. Department of Agriculture, *Agricultural Statistics*. Figures for all kinds of work animals for the past four decades may be obtained from the same sources which show a drastic decrease, especially since 1920, in the use of work animals on farms, as:

1910	24,211,000	work animals
1920	25,742,000	" "
1930	19,142,000	" "
1940	14,481,000	" "

³² For estimates up to 1935, see WPA, N.R.P. Report No. A-9, *Changes in Farm Power and Equipment: Tractors, Trucks and Automobiles* (Washington, 1938), pp. 62-63. For those in 1938, see Hopkins, p. 67.

represents the net result of displacement for the period concerned.

From various data available in the United States, it seems likely that about half the displacement of horses that occurred up to 1935, about 2.8 million, should be attributed to the truck and automobile and the remainder to the tractor.³³ At this rate the displacement caused by the tractor through 1938 would amount to 4.8 million work horses, or slightly more than 3 horses per tractor, and by modern transportation, slightly under 0.6 per truck or automobile. Both of these figures seem conservative and command a high reliability.

In the process of industrialization, both productivity per man and productivity per unit of land have gradually and continuously increased. And there is every sign of further increases in the future. As to productivity per man in agriculture, we may take the figures estimated by Ezekiel and Tolley for the United States as an example to show its increase and to compare it with that in manufacture and in mining.³⁴ (See Table 11).

It is clear that the output per worker in agriculture, which reflects productivity per man, has grown almost as rapidly as that in manufacturing and in mining during the past half century. The period covered is a most phenomenal one in the process of industrialization of the United States. It is to be noted, however, that since the beginning of the present century, man-productivity in manufacture has advanced more rapidly than that in both agriculture and mining.

Productivity per unit of land also increased in the various leading industrialized countries during the period of industrial-

³³ WPA, N.R.P. Report No. A-9, *Changes in Farm Power and Equipment*, pp. 62-65.

³⁴ Mordecai Ezekiel, "Population and Unemployment," *The Annals of the American Academy of Political and Social Science*, vol. 188 (November 1936), p. 236.

Quaintance, upon the census figures of the United States, arrived long ago at the statement that "in the last twenty years [1880-1900], by the aid of machinery and the substitution of horse power for hand power, the effectiveness of human labour on farms has been increased to the extent of about 33 per cent." This seems to be completely in accord with Ezekiel's estimated figures for the same period. See H. W. Quaintance, *The Influence of Farm Machinery on Production and Labour* (New York, 1904), p. 16.

TABLE 11

VOLUME OF OUTPUT PER WORKER IN THE UNITED STATES
(1900 = 100)

Year	Agriculture	Manufacture	Mining
1870.....	55	64	36
1880.....	7	75	56
1890.....	82	93	84
1900.....	100	100	100
1910.....	100	117	104
1920.....	119	131	139
1930.....	141	163	147

ization, although its rate of increase was far from remarkable. The average yield of wheat per acre in England and that of rice per hectare in Japan are shown in Table 12.

TABLE 12

AVERAGE YIELD OF WHEAT AND RICE*

Years	Bushels of wheat per acre in England	Years	Quintals of rice per hectare in Japan
1771.....	24.0	1878-87.....	13.4
1812.....	22.0	1888-97.....	15.1
1885-94.....	29.4	1898-1907.....	16.8
1899-1908.....	31.4	1908-14.....	18.8
1916-22.....	30.7	1925-29.....	21.6
1924-32.....	31.4	1930-34.....	21.9
1933-36.....	34.3	1936-38.....	24.0

* From Colin Clark, *The Conditions of Economic Progress*, pp. 256-258.

The average yield does not fully reveal the productivity per unit of land, because there were changes in acreage during the period which might have distorted the general trend of yields. For instance, the average yield of wheat per acre in England

was lower in 1812 (22 bushels) than in 1771 (24 bushels), but the acreage was greater in 1812 (3,160,000 acres) than in 1771 (2,795,000) acres.³⁵ From this it may be easily seen that the lower average yield in 1812 was largely due to the cultivation of some less favorable land. However, the above figures show unmistakably a general trend of advance from period to period in productivity of land.

In Denmark, for example, the most typical size-groups are farms between thirty-seven and seventy-five acres and farms of family type, and the agricultural production is one of the most efficient in the world. The yields of crops are much higher than in Britain, and in some cases are even the highest among all countries. Sixty years ago the Danish yields were no better than the British, but since then the former have improved faster than the latter, so that at the present time the Danish yields per acre of wheat, barley, and oats are 25 to 50 per cent higher than the British; yields of sugar beets are 50 per cent and of swedes 60 per cent higher. The Danish farmers' harvest is 44 cwt. of seeds of hay per acre as against the British 28 cwt., and 32 cwt. of meadow hay as against the British 20 cwt.³⁶ This contrast in grass production is the more striking when we remember that Britain has a far more favorable climate for grass growing. The Danes have achieved such high average yields by the use of better seed and more fertilizer. But a more important reason lies in the relative cheapness of cultivation. Compared with peasants elsewhere on the continent the Danish farmer saves an immense amount of labor by having his fields grouped round his farmstead; he does not have to spend one and a half to two hours each day in going to and fro to scattered strips. Compared with English farmers he is probably also more advanced in the use of machinery.³⁷

³⁵ Clark, p. 256.

³⁶ P. Lamartine Yates, *Food Production in Western Europe* (London and New York, 1940), Part II, Denmark, p. 33.

³⁷ Of the farms in the typical size-group, 53.5 per cent use an electric motor, 78 per cent a seed drill, 90 per cent a hay mower, and 70 per cent a self-binder. On the larger farms potato and sugar-beet lifting machines are becoming more and more common; on the smaller ones a very useful new implement tops and lifts swedes in one movement. See P. Lamartine Yates, *Food Production in Western Europe*, p. 36.

In livestock farming the Danes have quickly and thoroughly adapted themselves to the new change in production. The expansion of the Danish livestock industry is a great achievement resulting largely from industrialization in England and in Germany. With the market assured, the Danes have progressed far in cattle breeding and dairy production. Denmark was the first nation to realize the importance of breeding for performance. The Danes were the pioneers in milk recording, the first milk-recording society in the world being formed at Vejan in 1894. By dint of paying so much attention to scientific breeding the Danes have transformed their dairy herds from mediocrity into being as nearly as possible perfectly adapted to butter production. The progress in the performance of Danish dairy herds is remarkable. Milk per cow increased from 213 gallons in 1871 to 700 gallons in 1930, and butterfat per cow increased from 65 to 270 pounds in the same period.³⁸ It is important to remember that the Danish milk-producing industry is entirely in the hands of small family farmers; only 6.6 per cent of the total number have more than twenty cows on their farms. The system of co-operative dairies has contributed greatly to the improvement of production. The fact that Denmark was the first country in the world to adopt pasteurization in butter manufacture is to be attributed in great part to the coöperative system.

The size of a farm is often expressed by its acreage. But acreage is not the only measure. Labor, capital, and management are also the essential elements of a farm, and its size may be measured in terms of any one or any combination of these factors. It may even be measured by the value or physical volume of farm products. In our present discussion, however, only acreage is to be used. It is evident that the size of a farm is important in determining the extent to which labor-saving equipment and methods can be applied. This is particularly true of such mechanical equipment as combines and corn pickers and of some livestock equipment, like milking machines. But the application of many labor-saving methods is not affected by the size of the farm. The saving in labor from the adoption of higher yielding crops or livestock and from changing to more effective

³⁸ Danish Statistical Department: *Denmark*, 1931.

spray materials or more concentrated fertilizers can be obtained as readily on a small farm as on a large one. However, the greatest saving in labor during the end of the last and the beginning of the present century has resulted from mechanization, which can be achieved only under the general process of industrialization. It is, therefore, to be emphasized that mechanization is closely related to size.

In the United States, the average size of a farm is about 170 acres, according to the latest census.³⁹ Of course, the typical size varies widely with different types of farming and with different regions of the country. For the moment let us refer only to the over-all average size. Traced back to 1850 and up to 1940, the average size of farms has undergone changes in two opposite directions, as the following figures show.⁴⁰

<i>Year</i>	<i>Average Size of Farm</i>
1850	203 acres
1860	199 "
1870	153 "
1880	134 "
1890	137 "
1900	146 "
1910	138 "
1920	148 "
1930	156 "
1940	174 "

An inspection of the foregoing table shows that from 1850 to 1880 there was a constant tendency toward a smaller size, the year 1880 marking the smallest. Since then a clear tendency has been indicated toward larger farms.

A historian has stated that agricultural revolution in America, as far as the application of farm machinery is concerned, came in the half century after 1860.⁴¹ But the speed of industrializa-

³⁹ Derived from *U. S. Census of Agriculture: 1940*, published by U. S. Department of Commerce, Bureau of Census. 1944, vol. III, Chapter 1, Table 4.

⁴⁰ From the United States Census for different decades.

⁴¹ H. U. Faulkner, *American Economic History* (New York and London, 5th Edition, 1943), p. 379.

tion was not greatest nor its degree the highest until after 1870, when the iron and steel industry began to develop. In 1890 the United States produced over nine million tons of pig iron, surpassing England for the first time.⁴³ The development of the iron and steel industry is important because it conditions the birth and growth of the farm machinery industry. Thus only the decade of 1880 can be taken as the period in which the introduction of modern farm machinery was effectively and fully started. It is obvious that mechanization in agriculture has exerted a great influence in enlarging the size of farms to gain the internal economies. Since 1910 the distribution of farms by size has shown relatively little change. This may be due to the fact that most farms have already been large enough to undertake mechanization, and any further expansion would cause difficulty in management. Moreover, it is difficult to change the size of a farm unit once it has been established and equipped. The operator of the unit who feels that he can handle additional land may not be able to buy or rent land adjacent to the farm he has already acquired.

In England, it has been shown that from 1760 to 1880, economic factors favored the large-size farm.⁴⁴ It has also been statistically ascertained that from 1885 to 1931, the decline has been continuous in the two smallest size groups (one to five and five to twenty acres) and also in that containing the largest holdings (above three hundred acres); the size next to the largest (one hundred to three hundred acres) has remained almost unchanged, whereas medium-sized farms (twenty to fifty and fifty to one hundred acres) have been increasing numerically during the whole period.⁴⁵

It is very obvious that the movement of collectivization in Soviet Russia has greatly increased the size of the farm. In 1920 only 4.9 per cent of cultivated land area was collectivized. By 1931 the collectivized land area increased to 67.8 per cent, and by 1935 to 94.1 per cent. In 1940 the collective farms (Kolk-

⁴³ L. C. A. Knowles, *Economic Development in the Nineteenth Century*, p. 201.

⁴⁴ Hermann Levy, *Large and Small Holdings* (Cambridge, 1911), *passim*.

⁴⁵ J. A. Venn, *The Foundations of Agricultural Economics* (Cambridge, England, 1933), table on p. 110.

hozes) embraced 99.9 per cent of the cultivated land. When it embarked on the policy of mass collectivization, the Soviet government decided to promote the artel as the collective form suited to the economic and cultural level of the country and to Soviet policy. The process of converting communes and *tozes* (societies for joint cultivation) into artels was rapid. In 1929 *tozes* comprised 60.2 per cent of all collectives, communes 6.2, and artels 33.6 per cent; by 1934 communes comprised only 1.8, *tozes* 1.9, and artels 96.3 per cent of all functioning collective farms.⁴⁶ Collectivization of farms is similar to consolidation, although the fundamental spirit behind the movements is different.

The effects of the adoption of modern transportation on the market structure of agricultural commodities, and on the modes of agricultural production, are no less profound and far-reaching than the application of power machines and large implements. Of the same significance is the popularization of modern storage, especially of refrigeration. It is not difficult to see that improvements in transportation and storage have extended tremendously the market for all commodities, and particularly for farm products which are both bulky and perishable. Without an enlarged and assured market, application of machines to agriculture and expansion of farm organization would be impossible. Modern history has shown that the improvement of transportation and storage is a prerequisite to the existence of the modern farm and mechanization in agriculture.

Different means of transportation have worked with different effects upon the system of agricultural markets. Railroadization has made the market centralized. In England the famous Smithfield wholesale meat market at London rose to a position of commanding importance, and in its heyday was one of the most striking illustrations of the central market in the evolution of markets. In the United States, with its huge areas, the "central market" became a system of central or terminal markets, such as Chicago, Kansas City, and Minneapolis, with one market dominating the rest. The livestock marketing structure was

⁴⁶ G. S. Shepherd, *Agricultural Price Analysis*, Chapter 2, "The Evolution of Markets and Market Price Making," p. 14.

dominated by the terminal market at Chicago, the grain market by the Chicago Board of Trade, and the cotton market by New Orleans.⁴⁷ Since World War I, radios, trucks, and the concrete highways have made the market system tend toward decentralization. These transportation facilities have enabled more buyers and sellers to short cut the central market and do their buying and selling direct. The reasons are obvious. As market organization improves, grades are set up and market information reaches higher levels of accuracy and timeliness. The necessity for concentrating goods in central markets for physical inspection decreases, and decentralization of the market begins to occur. This is very evident in the case of livestock, grain, vegetables, and fruits. Decentralized markets of this type are far different from the unconnected and almost isolated markets that prevailed during the period of village community.

D. REORIENTATION IN TYPES OF FARMING⁴⁸

As industrialization enters a fairly mature stage, its effect on income will cause a demand for better food. Some industries using agricultural products as raw materials will expand and hence raise the demand for these primary goods. All this will lead to reorientation in the types of farming. In the foregoing section, we have discussed the reaction of the farm to changes in the market, and the consequent adjustment in its internal organization. Now, we may consider the shifting or reorientation in types of farming as a group phenomenon of farms when new products are introduced to replace the old ones. Shifting of an individual farm from one type of farming to another, such as from rice to wheat, or from wheat to corn or to cotton, may be made without involving a change of production function. This

⁴⁷ Shepherd, p. 14.

⁴⁸ "Types of farming," "lines of production" and "farming system" have been used almost interchangeably. It may be said that the phrase "types of farming" is more often used in the English-speaking countries, while the term "farming system" is only a literary translation of the German word "Betriebssystem." The term "lines of production" is much less popular. For discussions on "Betriebssystem" or types of farming, see Theodore Brinkmann, *Die Oekonomie des landwirtschaftlichen Betriebes*, in *Grundriss der Sozialökonomik*, Abteilung VII, pp. 30-32 (Tübingen, 1922). The book was translated into English by E. T. Benedict and others, under the title of *Economics of the Farm Business*, 1935.

has been briefly discussed in Chapter II under static assumptions. Our present concern is primarily with the shifting in types of farming that can be accomplished only if a new production function or a technological change is adopted. However, shifting of both categories would have to be effectuated through the price system.

In the process of industrialization, there are many other factors, in addition to the demand for better food, which have been working simultaneously to cause reorientation in the types of farming. Among them may be cited changes in feed crops and shifting from food crops to industrial raw materials. In the following pages, the discussion will be confined to these three forms of reorientation.

First, let us see how demand for better food has influenced the shifting in types of farming. An illustration may be taken from what has happened in England during the past two centuries. This was a time during which the English economic structure underwent tremendous change, and gave England first chance to become an industrial country. The whole period may be broken down into five sub-periods, namely, 1700-1760, 1760-1815, 1815-1846, 1846-1880, and 1880-1910.⁴⁹ In the first period, that is, from 1700 to 1760, nearly all social and economical circumstances favored the maintenance of small holders and small farmers, whose production consisted primarily of vegetables, butter, milk, pigs, poultry, fruits, and the like. The most obvious of these favorable factors were: good harvests, cheap price of corn (wheat), low rent, high wages, increasing demand for meat and dairy produce, and the improving means of transportation, such as improvements made in roads and the extension of the network of canals. Some of them were obviously the later-stage effects of the commercial expansion in the preceding two centuries. But the most important was the introduction of the field cultivation of roots (turnips), clover, and artificial grasses, which as a whole proved the pivot of agricultural progress. It enabled farmers to carry more numer-

⁴⁹ This division of the period is made by the present writer upon the data used and the analysis undertaken by Dr. Hermann Levy in his *Large and Small Holdings*.

ous, bigger, and heavier stock; more stock gave more manure; more manure raised larger crops; larger crops supported still larger flocks and herds. Without the aid of turnips the mere support of livestock in winter and spring had been a difficult problem; to fatten sheep and cattle for the market was in many districts a practical impossibility.⁵⁰ The work of some prominent figures in this period will be long remembered. So zealous was Townshend's advocacy of turnips as the pivot of agricultural improvement, that he gained the nickname of "Turnip" Townshend. But such improvements in arable farming could not yield their full profits until the livestock of the country was also improved. The necessary revolution in the breeding and rearing of stock was mainly the work of Robert Bakewell. This technical progress, together with the favorable economic conditions, caused the production of "protective" food to gain an upper hand.

The following two sub-periods, from 1760 to 1815 and therefrom to 1846, witnessed the beginning and the coming into full swing of industrial revolution. During these two periods, radical changes took place. The circumstances that once were in favor of small farmers turned against them and afforded advantage to the growth of large farms for producing wheat. The fifty years up to 1765 had been a period of extraordinarily good harvests. With the year 1765 this period of abundance came to an end. In the meantime, despite the fact that the home production of wheat was thus decreasing, population was increasing rapidly because of the initial effects of industrialization. As a consequence, England passed soon after 1750 from the position of a corn-exporting to that of a corn-importing country. But even increasing imports could not reduce the price to the low level of the first period, in view of the growing demand and the lessened home supply. On the contrary, the price of corn (wheat) rose higher and higher. The effect of the rise of corn prices plunged the mass of the people into misery, privation, and famine. The mounting rise of corn prices caused a drastic decrease in real wages. The acute agricultural depression in the period of 1814-

⁵⁰ For a more detailed discussion, see Lord Ernle, *English Farming; Past and Present*, Chapters 7 and 8, pp. 148-189.

1836 made the ruin of small owners and the misery of agricultural laborers more severe. Farm production shifted from protective food to energy-producing crops.

The fourth period, from 1846 to 1880, was, on the whole, a period of revival both for industry and for agriculture. The abolition of the Corn Laws in 1846, which marked the triumph of free trade, was one of the several factors that account for the prosperity in this period. In addition, there were some kinds of technical progress that made the cost of production in agriculture lower and reduced the price of food. The most important are the improvements in drainage, the introduction of chemical fertilizer, the extension of the use of machinery, and the cheapening of transportation, especially the great extension of railway network. The increased demand for land made rent higher, and this, in turn, made possible the continued extension of large holdings. On the other hand, along with the revival of industry, higher wages and higher purchasing power⁵¹ made a great increase in the demand for meat and hence a revival of pasture farming resulted. Thus in agriculture both the production of energy-producing food as represented chiefly by wheat farming and the production of protective food as revealed mainly in pasturing and gardening were in a prosperous condition. Some writers have called the farming system in this period "the mixed husbandry,"⁵² and it might well be called "the balanced husbandry." But whatever it may be called, the system was only a transitory one and marked a turning from crop-farming dominant to pasturing dominant agriculture.

The last period (1880-1910) in our illustrative case saw the

⁵¹ Increase in money wages and more in real wages of industrial labor during this period may well be shown by Bowley's Index numbers:

MONEY AND REAL WAGES IN THE UNITED KINGDOM, 1914 = 100

Year	Money Wages	Prices	Real Wages	Year	Money Wages	Prices	Real Wages
1860	58	113	51	1874	80	115	70
1866	66	114	58	1877	77	110	70
1870	66	110	60	1880	72	105	69

From A. L. Bowley, *Wages and Income in the United Kingdom since 1860* (Cambridge, 1937), Table VIII, p. 34.

⁵² See Levy, *Large and Small Holdings*, Chapter 3, especially pp. 61-70.

competition, especially in wheat from abroad (largely from the United States, Canada, and Russia), which brought about a drastic fall in wheat prices. The decrease in price made wheat growing in England unprofitable, and as a consequence many farms were abandoned. The favorable conditions which had existed since 1760 for the expansion of wheat farming were now coming to an end. The tide turned in the opposite direction. During this period wheat acreage fell off sharply, declining from the record acreage of 3,900,000 in 1869 to 1,400,000 in 1895.⁵³ Many acres were wholly withdrawn from cereal culture and converted to pasture. However, the purchasing power of urban earners had increased since 1880, owing chiefly to the fact that free trade brought in cheaper food.⁵⁴ The demand for meat, poultry products, and fruits was therefore greatly increased. The whole situation now became favorable to the production of protective food. In the meantime, many technical improvements were introduced and encouraged and made possible the development of specialized farms, such as dairying, stockbreeding, poultry, and horticulture. The trend has continued ever since 1910, with the interruptions only in the world-war periods.

The second form of reorientation in the types of farming is to be found in feed crops. The situation in the United States illustrates this. For a long time oats had been used for feed for horses. But in recent decades, because of the introduction of tractors, trucks, and automobiles, demand for oats has decreased as a consequence of the fact that horses have been

⁵³ Bowden, Karpovich, and Usher, *An Economic History of Europe Since 1750*, p. 589.

⁵⁴ The index number of real wage per earner in this period is given in the following: 1880, 70; 1881-1885, 77; 1886-1890, 89; 1891-1895, 98; 1896-1900, 104; 1901-1905, 103; 1906-1910, 103; and 1911, 100. See Bowley, *Wages and Income in the United Kingdom*, Table XIV, p. 94. Since 1866 the purchasing power of agricultural wages, expressed both in fractions of a quarter of wheat and in pounds of beef, has shown a steady increase.

PURCHASING POWER OF WAGES

	1867-71	1892	1907	1919	1925	1930
In quarters of wheat	0.22	0.44	0.49	0.52	0.60	0.88
In pounds of English beef	20.8	33.6	34.4	33.6	37.6	41.6

This was originally illustrated by C. S. Orwin and B. I. Felton; see *Journal of the Royal Agricultural Society of England* (1931), p. 255.

partly replaced. The farmer has to face the problem of finding something more profitable to put into his rotation. Some farmers have been attempting to solve this problem by substituting barley for oats. Barley is somewhat superior as a feed for fattening purposes. Between 1925 and 1928 the barley acreage of Iowa increased 453 per cent.⁵⁵ In that state, barley is still a very minor crop, its acreage amounting to only 14 per cent of that of oats. The 1928 figures show 794,000 acres of barley and 5,761,000 acres of oats. Nevertheless, the increase in barley acreage is significant and indicates for the most part a reduction of the oats acreage. A more satisfactory solution of the oats problem would seem to be the substituting for a considerable part of the present oats acreage high yielding legume crops, particularly sweet clover, which can be used both for rotation pasture and for plowing-under for the benefit of the soil. There is probably a more significant increase of sweet clover than of barley. Such a substitution is working toward an expanded crop rotation instead of the two-year swing from oats to corn and back again, which has characterized the region under discussion. It is working toward the standard Iowa four-year rotation of two years of corn followed by oats seeded with sweet clover, which remains on the land for another year for pasture and a manure crop.⁵⁶

Finally, the reorientation in the types of farming may take the form of shifting from food crops to crops destined for industrial use. Such a shifting presupposes a rise in the productivity per land unit. Only when the productivity of land is increased, can part of the acreage devoted to food crops be spared and converted to growing crops used as industrial raw materials. It need not be said that climate, rainfall, and soil play a more important role in this case than in the other two in determining whether the conversion is physically possible and economically profitable. This is because the required physical conditions for food crops and industrial crops are more divergent than for those within the group of food crops. Granted these

⁵⁵ The figures quoted here and in the following are from C. L. Holmes, *Types of Farming in Iowa*, Bulletin No. 256, January 1929 (Ames, Iowa), p. 162.

⁵⁶ Holmes, p. 163.

physical conditions, the shifting from food to industrial crops is a good indication of the effects of industrialization. Let us take the cotton production of the United States as an example. After 1870 there was an increasing demand for cotton both in Europe, especially on the Continent, and in the United States itself, especially in the South where cotton mills began to increase rapidly. To meet the demand, the cotton production in the United States expanded tremendously. More remarkable was the westward expansion of cotton production. From 1879 to 1931, the total production of cotton in the United States rose from 5,755,000 bales to 17,095,000 bales, increasing about three times in half a century. In Texas the cotton production rose from 805,000 to 5,322,000 bales in the same period, increasing more than six times. In Oklahoma the cotton production rose from none in 1879 to 227,000 bales in 1899 and 1,261,000 bales in 1931.⁵⁷ Part of this increased acreage was, of course, obtained through the cultivation of new land, but part of it must have gained at the expense of other crops. To what extent the added acreage of cotton was achieved under reorientation remains to be ascertained. Nevertheless, the effect of industrialization on the expansion of cotton production is very clear. In an old country like China, where most of the arable land, under a given technology, has been put under cultivation, the shifting from food crops to cotton is even more illustrative. From 1926 to 1936, the cotton acreage in China increased more than 70 per cent. Most of this acreage was undoubtedly obtained by conversion from food crops.

Reorientation in the types of farming during the later stages of industrialization has been briefly discussed. The various forms of reorientation under the foregoing analysis do not necessarily take place on account of the existence of obstacles. First of all, physical conditions, including climate, rainfall, and soil, play a most important role in determining whether a shifting is to occur, and if it does, under what form. For example, in North China, the demand for rice has increased in recent decades, either owing to the migration of population from the South,

⁵⁷ Emory Q. Hawk, *Economic History of the South* (New York, 1934), pp. 453-454.

or because of the rise in income of urban people, tending toward consumption of more rice; however, the shifting from the native food crops, such as wheat, corn, and millet, to rice does not take place. The absence of such shifting is largely due to the unfavorable growing conditions for rice in North China. Another example is the growing of cotton. Cotton requires a warm climate and a moderate rainfall, and its growing is therefore limited to the southern part of the North Temperate Zone and the northern part of the South Temperate Zone. Outside of these areas, the present state of technology gives no prospect for cotton growing even though the expansion of cotton mills demand it. The second modifying factor is transportation. Development in transportation has made one region able to use the farm products and raw materials grown in other regions. This would have relieved the necessity for the first region to reorient its types of farming. Furthermore, the increasing tendency toward international division of labor has also reduced to some extent the urgency for reorientation for individual countries. In the expanded process of textile industries in Great Britain, the raw materials, such as silk, cotton, and wool, were almost entirely acquired from China, Japan, India, and Australia. Great Britain has not found it necessary to attempt to achieve the otherwise necessary shifting in the types of farming.

E. THE PLACE OF AGRICULTURE IN THE TOTAL ECONOMY

We have seen that industrialization is characterized by changes in the strategical technology and the consequent adjustments in economic organization and social institutions. During the process, agriculture, which as a field of production is closely linked with other fields of economic activities, is necessarily subject to change. An analysis of the changes which occur in agriculture itself has been made in the foregoing sections. It remains now to ascertain the place that agriculture would have to hold in a given economy during the process of economic transformation. The place of agriculture is here interpreted as the relative importance of it compared with other fields of economic activities. It is obvious that the place of agriculture, like that of other fields, is changing from time to time. Thus a cer-

tain section of the process will be presented so that the situation in the beginning and the later stages may be compared to it. To choose a proper section is a difficult problem. Moreover, to select a measure by which the relative importance of agriculture can be properly expressed is another problem, even more difficult to solve. The occupational distribution of population is one measure that is commonly used. Another is the proportion of National Income or National Product in different fields of production. This latter is more sound but less often used because of the inadequacy of statistics. In the present discussion, both measures will be employed. Although in Chapter II we have already dealt with the occupational shift of population but under different assumptions,⁵⁸ and although the proportion of population is not as accurate a measure as the proportion of National Income (because of far larger difference in labor productivity), more attention will be given to it for the realistic reason of statistical availability.

In theory, it may be stated that, owing to the low income-elasticity of demand for food and for raw materials for clothing, agriculture cannot escape from playing a declining role as soon as industrialization reaches the point of obtaining for the people a "reasonable" standard of living. Up to that point demand for food increases as income grows but, thereafter, demand for food decreases, first relatively and later absolutely, as income further rises. The coming into being of such a situation, as analyzed in Chapter II,⁵⁹ is the double operation of Engel's law and the fundamental psychological law which has been fruitfully used by Lord Keynes. To repeat: the former states, that as family expenditure increases, the proportion spent for food will decrease, and the latter is that "men are disposed, as a rule and on the average, to increase their consumption as their income increases, but not by as much as the increase in their income." Therefore, as income increases, expenditure will increase, but at a lower rate, and the proportion going for food will be even smaller. To a large extent it applies as well to clothing and the raw materials used for it. But this does not mean that agricul-

⁵⁸ See Chapter II, Section C, Labor Force as a Linking Factor.

⁵⁹ See Chapter II, Section A, Food as a Linking Factor.

tural activity will be on the decline. What it means is that the relative share of agriculture in terms of National Output or National Income will tend to decrease, while the absolute amount of agricultural activity may and most probably will keep on expanding without any serious slackening. Experiences of some industrialized countries have vindicated this statement.

Before making an inquiry into the relative place of agriculture in terms of working population and National Income, it will be profitable to describe briefly the rate of growth in agriculture and to compare it with the rate of growth in industry and other fields of production. In Chapter III the annual rate of growth in production was employed as a measure of the speed of industrialization. Also we have given the annual rate of growth for several fields of production which are considered strategical in the process under inquiry. Here the annual rate of growth in agriculture will be compared first with the natural growth of population and then with other fields of production, to see the characteristics of the evolutionary changes involved.⁶⁰

TABLE 13

AVERAGE ANNUAL RATE OF GROWTH IN AGRICULTURE
COMPARED WITH OTHER FIELDS OF PRODUCTION IN THE
UNITED STATES

Index	Period covered	Annual rate of growth
Population	1870-1930	1.9
Agriculture	1870-1930	2.5
Manufacturing	1849-1929	4.8
Mining	1870-1930	5.7
Transportation & Communication	1866-1914	5.8
Trade	1870-1929	5.2

⁶⁰ The annual rate of growth for agriculture is based upon the Warren-Pearson index. Those based upon other indexes, such as the Day-Person's, the Snyder's and the Timoshenko's, giving respectively an annual rate of growth for agriculture of 2.3, 2.2 and 2.4, vary little from the one we quote. As to their statistical sources, see Burns, *Production Trends in the United States Since 1870*, footnote on pp. 262-264. For the sources for the rate of growth in the fields other than agriculture, see this essay, Table 6.

It shows that the annual rate of growth in agriculture in the United States during her most phenomenal stages of industrialization was 2.5 per cent, a rate indicating quite a remarkable annual increase in agricultural production. Comparing this increase with the growth of population, the annual rate of which is 1.9 per cent, it clearly shows an increase of per capita share of farm products under a given distribution of income. But a comparison of the annual growth of agriculture with that of other productive activities puts the former in a relatively unfavorable position. The annual rate of growth in agriculture is nearly one-half smaller than the annual rate of growth in the manufacturing industry which is 4.8 per cent, and more than one-half smaller, if compared with mining, transportation, and trade. The difference in the rate of growth in the fields under comparison is chiefly due to the difference in the income elasticity of demand for their products and services and also due to their various degrees of expandibility of production structure as limited by the technological factors.

The growth of an industry or a production line is conditioned by the rate of returns obtainable in an expansionist process. In an empirical study on the corporate size and earning power, Crum arrives at a statement that "it cannot be doubted that differential rates of returns — real or expected — among enterprises of different size exert a powerful influence upon industrial organization."⁶¹ He also concludes that his findings show that "on the average, large enterprise — in all or nearly all broad lines in industry, and in different stages of economic cycles — is more profitable than small enterprises, especially very small enterprises."⁶² Although his study is confined to the period from 1931 to 1936, years of depression or of downward economic trend which may not well fit our purposes, his finding on the rate of returns for different fields of production will, nevertheless, prove illustrative and explanatory of the difference in their rate of growth. His six-year average (1931-1936) of

⁶¹ W. L. Crum, *Corporate Size and Earning Power* (Cambridge, Mass., 1939), p. 6.

⁶² Crum, p. 7.

the rate of returns for agriculture and for other fields of production for the United States follows:⁶³

<i>Aggregate</i>	.97
Agriculture	—2.30
Mining	— .75
Manufacturing	2.15
Public Utilities	1.52
Trade	.54

During this period there was negative return for both agriculture and mining. The largest returns were given to manufacturing and public utilities. This categorical difference in the positive and negative returns, as well as the difference in the rate of them, may be largely due to the operation of the Acceleration Principle during the downward phase of the business cycle. But in any way it shows the relatively unfavorable condition for agricultural production, a condition made worse during the depression.

It is easier to find statistical data about the distribution of population than about the proportion of National Income. The percentage of urban population, which is an index of urbanization, may be used as a rough indication of the degree of industrialization. Table 14 shows the percentage of urban population in various countries in the period following World War I.⁶⁴ The percentage of urban population varies greatly with different countries. The contrast is most remarkable between England and India, a fact that may well explain the relationship between a master country and its colony. It should be noted that the percentage given in the table does not imply that the rest of the population in each country is entirely agriculturally employed. For example, in England and Wales, the percentage gainfully employed in agriculture was actually 7 per cent and not 22 per cent; in the United States it was 26 per cent and not 49 per

⁶³ Crum, p. 251.

⁶⁴ From John D. Black, *Agricultural Reform in the United States* (New York and London, 1929), pp. 40-43.

cent.⁶⁵ This is so because many people live in the country, but work in adjoining cities or mines. Thus many people living in rural communities should be classified as industrial. However, the preceding percentage, despite its roughness, can still be taken as a fair indication of the degree of industrialization.

TABLE 14
PERCENTAGE OF URBAN POPULATION

Country	Percentage	Country	Percentage
England and Wales.....	78	Japan.....	40
Germany.....	65	Italy.....	40
Australia.....	63	Sweden.....	26
United States.....	51	Switzerland.....	25
France.....	46	China.....	25
Belgium.....	44	South Africa.....	25
Denmark.....	41	India.....	11

Several highly industrialized countries show the change in the proportion of agricultural population. The countries to be studied are the United States, Great Britain, France, Germany, and Japan. The period under treatment covers one hundred years, from 1830 to 1930, a period that saw the most phenomenal transformation in the economic structure. Here the agricultural population is confined only to working people, and the figures for it are compiled from many sources.⁶⁶

From Table 15 we see clearly that the percentage of working population engaged in agriculture has been rapidly declining in the past hundred years. During that period, the United States was transformed from a country consisting primarily of agricultural workers into one dominated by industrial and commercial people. The same is true with France and Germany. Great Britain was far ahead of other countries in this transformation, and her percentage of agricultural working population is

⁶⁵ John D. Black, *Agricultural Reform*, Table 6, p. 43.

⁶⁶ Most of the sources will be found in Clark, *Conditions of Economic Progress*, pp. 185-192.

the lowest of all. Japan started industrialization after 1868, but did not get it fully under way until the beginning of the present century. Even as late as 1930 her agricultural working population was still half of the total. On the whole, it may be said that the decrease in the percentage of the working population in agriculture has become a general and common tendency in the world during the past and present century. The rate of decrease and the time it started vary with different countries, depending upon resources, technology, and institutional background.

TABLE 15

PERCENTAGE OF WORKING POPULATION ENGAGED IN AGRICULTURE*

Year†	U. S. A.	Great Britain	France	Germany	Japan
1830	70.8	...	63.0	...	...
1840	68.8	22.7	...	...	...
1850	64.8	21.9	...	...	...
1860	60.8	18.7	...	...	...
1870	53.8	14.8	42.2	...	84.8
1880	49.4	12.0	...	39.1	...
1890	42.6	10.2	...	...	77.8
1900	37.4	8.4	34.1	33.3	71.8
1910	31.9	8.0	...	27.0	61.5
1920	26.7	7.1	28.6	...	55.1
1930	22.5	...	24.5	22.2	50.3

* Including forestry and, except France and Germany, fishing.

† These years apply exactly only to the United States. For other countries, each year will be taken as representing a range of ten years, that is, for example, the year 1840 will be taken as representing the range of 1836-1845.

In some countries whose production is even now primarily agricultural, the change in the percentage deserves to receive special attention. We shall take Denmark and Australia as examples.⁶⁷ In both these countries the percentage of agricultural working population has been on the decrease. Australia has been obviously ahead of Denmark in the transformation. The most

⁶⁷ Statistical data for Australia are to be found in the *Commonwealth Year Book* of various years. Those for Denmark are from Clark, *Conditions of Economic Progress*, p. 196.

characteristic feature lies in the fair constancy of the ratio of industrial working population to the total population. For more than half a century the percentage of industrial workers in Australia has risen only from 27 per cent to 32 per cent. In a quarter of a century, that in Denmark rose only from 25 per cent to 27.5 per cent, an increase of 2.5 per cent of the total population. Table 16 clearly shows that most of the workers released from agriculture have been transferred, not to industry, but to transport and commerce. The functions of transport and commerce are no less important to agricultural enterprises than to industrial undertakings. However, the peculiar situation of Australia and Denmark, that is, the fair constancy of the percentage of industrial population and the direct transfer of labor from agriculture to transport and commerce, can exist and endure only by maintaining close economic relations with those countries where industry is highly developed.

TABLE 16

PERCENTAGE OF WORKING POPULATION ENGAGED IN AGRICULTURE, INDUSTRY, TRANSPORT, AND COMMERCE, 1871-1931*

Year	Australia				Denmark			
	Agri- culture	In- dustry	Trans- port	Com- merce	Agri- culture	In- dustry	Trans- port	Com- merce
1871	44.2	26.7	3.8	8.2	...	...	...	...
1881	38.5	29.7	4.5	9.3	...	...	...	...
1891	31.1	31.1	6.9	12.3	...	...	...	...
1901	32.8	26.9	7.2	13.1	48.0	24.9	...	...
1911	30.1	28.8	8.2	14.5	43.1	25.0	4.4	10.8
1921	25.7	31.3	9.1	14.4	35.1	27.4	6.0	10.9
1931†	24.4	32.1	8.3	16.7	36.4	27.5	5.9	12.5

* For Australia, agriculture includes mining; for both countries, transport includes communication.

† The exact year for Australia is 1933, and for Denmark, 1930.

Decrease in the percentage of agricultural working population is made possible only when improved farm technology is introduced. This is so because, first, during the initial stage of industrialization, population becomes greater not only in num-

bers, but also in rate of increase. Taking the world as a whole, or taking a closed economy with no trade with other countries, demand for food will increase and its pressure on food supply will begin to operate. Even assuming that there is still some land available for cultivation and assuming the maintenance of the same ratio of agricultural population, it will take more than proportional effort to increase food production in order to meet the new demand, because the new land is most probably less fertile than that already under cultivation. Second, if we maintain the first assumption and drop the second, the effort required to increase food production will be even greater. The same will be true if we maintain the second assumption and drop the first, owing to the operation of the law of diminishing return. Finally, if we drop both assumptions, that is to say, no new land is available and the percentage of agricultural population is on the decrease, the effort required will be drastically increased. Under these conditions, only the introduction of a new farm technology can increase food production to a degree sufficient to meet the increased demand. It will be more so if raw materials for clothing and for other necessities are included.

However, it must be remembered that we have assumed, from the very beginning, an economy of full employment. Thus the ratio of agricultural working population can be decreased only when a new farm technology is introduced. But actually this is not always the case. In old countries there was always a great surplus in agricultural labor when industrialization was first under way. This surplus can be employed for production of food and raw materials to meet the increased demand. Moreover, this surplus labor in agriculture can be directly or indirectly transferred to industrial and commercial uses. Thus during the beginning stage of industrialization, decrease in the amount and even in the ratio of agricultural working population may take place without introducing a new farm technology. But in later stages, the surplus will be gradually absorbed. At that time a new farm technology must be introduced, and only then can it be profitably adopted because labor begins to become scarce and costly. The modification as here introduced by recognizing the

fact that underemployment exists is so significant it needs always be borne in mind. It shows a time lag that is crucial in formulating an economic policy for a country which is yet to be industrialized.

Now, let us turn to the measure of the proportion of National Income. The United States will again be used as an example. Table 17 shows the percentage shares of agriculture and manufacturing in realized income during the period of 1799-1937.⁶⁸ It is evident that during the past nearly one hundred and forty years, while the percentage of other activities has maintained a state of fair constancy, the relative importance of agriculture, as shown in the proportion of its realized income, has decreased from 40 per cent to 12 per cent, a decrease of more than two-thirds, and that of manufacturing has increased from 5 per cent to 30 per cent, an increase of six times. The decades from 1819-1829 and 1879-1889 are especially worthy of notice. During these two periods, manufacturing activities were expanding at a rate greater than ever. That is understandable if we remember that the first decade was started with the process of "railroadization" and the second saw the beginning of the expansion of the iron and steel industry. The rapid decrease of the percentage share of agriculture in the realized income did not take place until 1869, a period that marked the end of the Civil War and the beginning of the most remarkable process of economic transformation in American history. World War I checked the decrease for a moment, but thereafter the general trend has continued.

A comparison of the change of the proportion of agriculture in National Income and the change of the percentage of agricultural working population during the period of 1830 to 1930

⁶⁸ From R. F. Martin, *National Income in the United States, 1799-1938* (Washington, 1939), Table 17. A good discussion will be found in Harold Barger and H. H. Landsberg, *American Agriculture, 1899-1939: A Study of Output, Employment and Productivity*, Chapter 8, "Agriculture in the Nation's Economy," especially a note by C. R. Noyes on pp. 316-321. The income totals on which Martin's percentages are based include neither corporate savings nor income produced by government. On this account the percentages shown in the following table for agriculture and for manufacturing run somewhat higher than those given by Simon Kuznets, in *National Income and Its Composition, 1919-1938* (New York, 1941), Table 2.

shows us clearly that in both cases the rate of decrease was almost the same. In the case of the United States, the ratio as measured in income decreased from 35 per cent in 1829 to 13 per cent in 1929; the ratio as measured in population fell from 71 per cent in 1830 to 23 per cent in 1930. Both showed a

TABLE 17

PERCENTAGE SHARES OF AGRICULTURE AND MANUFACTURING IN
REALIZED INCOME IN THE UNITED STATES, 1799-1937

Year	Agriculture	Manufacturing	Other activities
1799.....	39.5	4.8	55.7
1809.....	34.0	6.1	59.9
1819.....	34.4	7.5	58.1
1829.....	34.7	10.3	55.0
1839.....	34.6	10.3	55.1
1849.....	31.7	12.5	55.8
1859.....	30.8	12.1	57.1
1869.....	24.1	15.9	60.0
1879.....	20.7	14.5	64.8
1889.....	15.8	21.1	63.1
1899.....	21.2	19.6	59.2
1909.....	22.1	20.1	57.8
1919.....	22.9	25.8	51.3
1929.....	12.7	26.2	61.1
1937.....	12.3	30.3	57.4

decrease of about one-third over one hundred years. It is also to be noted that the ratio of the percentage of agricultural income to the percentage of rural population has remained almost the same throughout the period. In 1830, the ratio was 35 per cent : 71 per cent; in 1930, the ratio was 13 per cent : 23 per cent. Such a concurrence cannot be accepted as purely coincidental. Because a fair ratio of the percentage income of any group to the percentage of the number of the same group is 1 : 1, the preceding situation reveals unequivocally the fact that agricultural workers have been living under an unfavorable condition.

From the above analysis it may be concluded that, with the start of industrialization, the predominance that agriculture

once held in the total economy of the world has begun to give way to manufacturing, transport, and commerce. Not only the predominance is gone, but also its relative importance in terms of working population and National Income is gradually on the decrease. In comparing the index numbers of net farm income, labor income, and capital income from 1910 to 1940, Black concluded that

the general impression conveyed is that of an agriculture relatively subsiding so far as income is concerned. It has also been subsiding in terms of physical output. This is true not only in the United States, but the world over whenever the levels of living of the people are rising. As any people becomes more productive per capita, and has a larger real income, it spends more of it on goods and services in cities, and less of it on food and the raw materials of clothing.⁶⁹

In no sense, however, does this imply that the absolute amount of agricultural production has been slackening in the process under consideration. Far from that, by the help of modern transport and the efficient marketing organization and by the benefit gained from the development of industry, agricultural production has been expanding on a scale never before seen in its history. It is only the fact that the rate of its expansion is smaller than that of other fields, especially of industry, which accounts for its decline in a total economy.

⁶⁹ Black, *Parity, Parity, Parity*, p. 101. In another place Black says that "in a growing economy like that of the United States, agriculture can scarcely hope to expand as fast as industry and trade." (p. 108).

CHAPTER V

EFFECTS OF INDUSTRIALIZATION ON FARM LABOR

THIS CHAPTER will deal with the problem of whether industrialization has done farm labor benefit or harm. Farm labor includes both laborers participating directly in the farm work, the so-called farm labor in a strict sense, and those who help the farm business in an indirect way, such as the "externally conditioned labor" on a family farm. First, I shall make a brief survey of theories in relation to compensatory effects, and from that survey try to make it clear whether the introduction of machinery is beneficial or harmful to labor, and if it is beneficial, in what way and to what extent. Next, both the absolute and the relative share of labor in agricultural returns will be determined. In discussing the relative share, a comparison of labor income with that of land, capital, and management in the total agricultural income will be made. Furthermore, labor transfer from farm to factory will be analyzed. Here the labor transfer presupposes a technological change, to differ from the discussion in Chapter II which was made under static assumptions.

A. THEORIES ON COMPENSATORY EFFECTS

One of the most important forms of technological change is the introduction of machinery. The effect of machinery upon society in general and upon the condition of the worker in particular has long been a topic of controversy. Arguments stating that the effect is beneficial have been called "the theory of compensation," and most of its advocates belong to the Classical School. In the present essay, the term "compensatory effects" is used in a broad sense in which it is to mean both the beneficial and harmful aspects of introducing machinery. The effect will also be investigated from the point of view of the

factors of production, land, labor, and capital. More attention will be paid to labor because labor migration from rural to urban areas or from agricultural to industrial undertakings is one of the most phenomenal changes in the process of industrialization.

Even in the second half of the eighteenth century, during the early stages of industrial revolution, there was speculation as to the effects of the new machinery upon the condition of the worker. By the beginning of the nineteenth century, the two trends which have persisted in the discussion of the subject found expression on the one side in the writings of J. B. Say, who presented the first consistent statement of the optimistic view, and on the other in those of Lord Lauderdale who first emphatically raised the question whether the unrestricted use of machinery was always of benefit to the laboring population.¹ Say took the view that machinery would benefit society in general and the worker in particular. His position was based on his "Law of Markets" — that production creates its own demand. The introduction of machinery means a saving in costs and lowers prices, which in turn causes an expansion of the demand for goods in the same or new industries, and ultimately an increase in employment. He admitted that machines displace workers, but he thought that such displacement is a temporary and transitory evil rectified by the growth of wealth and by increased employment which will follow as a result of lower prices due to greater productivity. Lord Lauderdale's main argument was that capital is productive and adds to national wealth only in so far as it serves to supplement labor or to perform such labor as could not otherwise be performed. Hence a country could not be benefited by a greater accumulation of capital than could be employed to supplement labor in the production of those things for which a demand already exists. He argued against capital formation through "parsimony" which

¹ J. B. Say, *Traite d'économie politique* (Paris, 1814); Lord Lauderdale, *An Inquiry into the Nature and Origin of Public Wealth* (Edinburgh, 1819). Discussions will also be found in Work Projects Administration, National Research Project, *Survey of Economic Theory on Technological Change and Employment* (Washington, 1940); and TNEC, *Technology in our Economy* (Washington, 1941).

meant a decrease in the demand for consumers' goods, and a corresponding diminution in the demand for labor. This argument anticipated in part the construction of modern Keynesian theory.

These two lines of argument on the effects of machinery were further strengthened and elaborated by Simonde de Sismondi and Ricardo who shared the pessimistic view and by J. R. McCulloch standing on the optimistic side. Sismondi attacked the idea that machinery was an unmixed good and that workers displaced by machinery were automatically reemployed. To him, invention and the introduction of machinery could be an unmixed benefit only if preceded by an increase in demand for goods and for labor which would allow the employment elsewhere of the labor displaced by machinery.² In the third edition of his *Principles*, Ricardo included a new chapter, "On Machinery," in which the arguments were far different from the unqualified optimistic views of his disciples. He was convinced that "the substitution of machinery for human labour is often very injurious to the interests of the class of labourers"³ and that "the opinion entertained by the labouring class that the employment of machinery is frequently detrimental to their interests, is not founded on prejudice and error but is conformable to the correct principles of political economy."⁴ Ricardo's followers, however, were not convinced by their master's reasoning on this question, and in general took the optimistic view. They elaborated the "compensatory principle" according to which the workers displaced in one trade or industry are soon reabsorbed in the same or new industries. The most systematic statement of the theory at the time was given by McCulloch. He dismisses Ricardo's main argument by saying that it is entirely hypothetical. He argues that "in the actual business of the world, machines are never introduced to lessen but always to augment gross produce."⁵ As machines are introduced, prices of com-

² J. C. L. Simonde de Sismondi, *Nouveaux principes d'économie politique* (2nd edition, Paris, 1827; 1st edition, 1819).

³ David Ricardo, *Principles of Political Economy and Taxation* (London, 1821), pp. 468-469.

⁴ Ricardo, p. 474.

⁵ J. R. McCulloch, *Principles of Political Economy* (Edinburgh, 1830), p. 199.

modities are reduced, the demand for such commodities increases, and an additional number of hands is employed to supply the increased demand. If the demand for a specific commodity is inelastic, the reduction in its price releases income, which can be used either for purchase of other commodities or for savings which lead to an increase of capital. On the whole, the introduction of machinery does not diminish the demand for labor, nor does it reduce the rate of wages.

Following Ricardo, John Stuart Mill restated more adequately the classical position though with "some modifications." Mill stresses the different effects which the circulating and fixed capital have thrown on the "gross product" of a country, upon which the condition of the workers depends. Whether machinery and improvements will injure the interests of the workers depends on whether the increase in the fixed capital takes place at the expense of the circulating capital. This is because, according to Mill, it is consumers who, through their demand for specific products, determine the direction of labor. But the quantity of labor employed is determined by the amount of circulating capital which is directly applied to the sustenance and remuneration of labor.⁶

In *Das Kapital*, Marx devotes a long chapter to discussing "machinery and modern industry," especially the effects of machinery on the status of the worker.⁷ His analysis of the effects of machinery is closely interwoven with his general economic doctrines, that is, with his theory of value and of the formation of "surplus-value" on the one hand, and with his general law of capitalist accumulation on the other. On the whole, it appears to him that the effects which the machine has thrown on the workers under capitalism spring not from the nature of the machine, but from the way in which it is used by "capital," that is, by the employer interested in exchange-value and in "surplus-value." Marx bitterly criticized the theory of compensation as launched by what he termed "a whole series of

⁶ John Stuart Mill, *Principles of Political Economy*, edited by W. J. Ashley (London and New York, 1909).

⁷ Karl Marx, *Capital*, Chapter 15, "Machinery and Modern Industry," pp. 405-556.

bourgeois political economists" which includes James Mill, McCulloch, Torrens, Senior, and John Stuart Mill.⁸ That theory, as mentioned before, states that all machinery, which displaces workmen, simultaneously and necessarily sets free an amount of capital adequate to employ the same workmen. Marx contends that this will never happen, because every time a machine is introduced, a part of capital, instead of being set free, is locked up in such a way as to cease to be exchanged for labor-power: variable capital (labor) has been changed into constant capital (machinery).⁹ Thus, this effect of machinery is not a compensation, but "a most frightful scourge." Marx realized that

the labourers that are thrown out of work in any branch of industry, can no doubt seek for employment in some other branch. [But he argued] if they find it, and thus renew the bond between them and the means of subsistence, this takes place only by the intermediary of a new and additional capital that is seeking investment; not at all by the intermediary of the capital that formerly employed them and was afterwards converted into machinery.¹⁰

During the turn from the nineteenth to the twentieth century, the new postulates, methods, and concepts of economic theory, associated with the work of Jevons, Alfred Marshall, J. B. Clark, the Austrians, and the Lausanne School, were elaborated by numerous followers and were combined into a system of "neo-classical economies." In so far as the relation of technology to employment was concerned, the representatives of this school during this period saw no serious problems. On the whole, they harked back to the optimistic views of J. B. Say and the English Classical School, and reinforced them with the concept of "economic equilibrium." For example, in Marshall's *Principles of Economics*, the word unemployment does not occur, and his references to "discontinuous" employment are few and unimportant.¹¹ The general assumption is that all factors of produc-

⁸ Marx, Section 6 in the same chapter, pp. 478-488.

⁹ For illustration, see Marx, pp. 478-79.

¹⁰ Marx, p. 481.

¹¹ In one place he speaks of "inconstancy of employment" in modern industry and said "several causes combine to make it appear to be greater than it really is." (p. 687.)

tion, while competitive in a degree, are primarily complementary and constitute the field of employment for each other. Thus the neoclassical theory rests on a concept of "static" equilibrium, and it is obvious that the technological change has no place in an economic system under static assumptions.

In contrast to the elaboration of the equilibrium concept and static analysis was the decidedly forward step taken in the development of "dynamic" analysis and of the doctrines dealing with economic fluctuations and crises. Aftalion, Tugan-Baronawski, Lescure, Spiethoff in Europe and Wesley C. Mitchell in the United States were the pioneers. At the same time another line of thought was taking form, which was severely critical of the neoclassical theories and which has exercised considerable influence on economic doctrine and policy. John A. Hobson in England and Thorstein Veblen in the United States were perhaps the most important among its representatives. Hobson stressed the shifts in the distribution of the labor supply caused by machinery and the influence of machinery on industrial depressions through its stimulation of oversaving or the intensification of underconsumption. Veblen gave brilliant expression to the idea that technological progress must accentuate the opposition between the "machine process" and "business enterprise" and must involve the latter in ever more acute conflict with the needs for the preservation of capital, full employment of economic resources, and the development of social and economic values.¹² These two writers may be regarded as having reinterpreted the doctrines of Sismondi and Marx, being thus closely related to the neo-liberal and neo-Marxian trends of thought of the day.

The development of theories on compensatory effects has been stated briefly. It is not difficult to see that each school, the optimists and the pessimists, has gone to an extreme. The pessimists, from Lord Lauderdale and Ricardo, through Marx and Marxists, down to Hobson and Veblen, emphasized only the short-run effects and paid attention only to the firm or the industry where a machine is introduced and workers are displaced. On the other hand, the optimists, led by J. B. Say and

¹² TNEC, *Technology in our Economy* (Washington, 1941), p. 36.

including most of the English classicists, stressed only the long-run effects and assumed no "frictional" unemployment.

A more objective and broader approach will convince us that it is impossible to make any simple statement as to the effect of machinery. Whether it is beneficial or harmful depends upon whether we have in mind the long-run or short-run effects. In the short run, the introduction of a new machine or a new process which is labor-saving in nature will undoubtedly drive out some workers from the firm or the industry. It takes time and pains for those displaced to find other employment. In the long run, because technological improvements increase the production efficiency and raise the national income, and sooner or later will create new chances of employment, workers thus displaced will be theoretically reemployed. In this connection, the short-run outlook approaches the problem from the viewpoint of a particular firm or industry while the long-run outlook attacks it from the viewpoint of the whole economic society. Secondly, the effect of machinery depends upon the elasticity of demand for different commodities of different industries. The amount of labor displacement will vary inversely with the elasticity of demand. In other words, whether the elasticity of demand for a commodity is equal to, greater than, or less than unity, will determine the degree to which the price will be reduced, the extent to which market demand and production in the same industry will expand, and consequently the number of workers that may be employed in the same industry or may have to seek employment elsewhere. Paul H. Douglas is among the few writers who first gave a systematic analysis of this aspect and of whom more will be said later on. In the third place, every time a new machine or method is introduced, adjustments in one way or another will have to be made. During the process of adjustment, unless in a well-planned economy, some sort of "lag" and "disorder" will necessarily follow. This would mean that some factors of production will temporarily lie idle, or will be scrapped once and for all from the production organization. If the factor of production happens to be labor, as it is assumed in the present discussion, then so-called "frictional" unemployment will necessarily take place. In a free and competitive society, such a lag,

disorder, or frictional unemployment is considered a necessary price to be paid for social and economic progress. By that philosophy, this harmful effect is rather justified. But nowadays, in the light of the facts disclosed by recent studies, economists are ready to admit that the transfers of labor and capital made necessary by technical changes might cause serious deprivations to the workers, and it would be unjust to let the individual workers suffer the hardships which by no means were due to their own faults. Therefore, action by the government in preventing, mitigating, or remedying such hardships is necessary.

In the period following World War I, attention was called first to prosperity and technological unemployment during the late twenties and later to depression and mass unemployment during the early thirties. Among the writers who have given a systematic analysis of the problem, Douglas is especially worthy of mention.¹³ According to his study, the amount of displacement of workers from their former to other occupations will vary inversely with the elasticity of demand, the importance of labor in the final production, the degree of competition, and the relative importance of the operation or operations primarily affected by the technical changes. In other words, the amount of displacement from former to other jobs because of technical changes will be greater (1) the less the quantity demanded of a commodity increases with a given reduction in price per unit; (2) the less the proportion which labor costs form of the total expenditures; (3) the less the degree to which a reduction in costs will reduce price; and (4) the less important the operation to the whole industry. In the long run, also according to this analysis, the improved machinery and greater efficiency of management do not throw workers permanently out of employment nor create permanent technological unemployment. Instead, they raise the national income and enable the level of earnings

¹³ Paul H. Douglas, "Technological Unemployment," *American Federalist*, vol. 37, No. 8 (August 1930), pp. 923-950. Works of other writers concerning this problem are: W. I. King, "The Relative Volume of Technological Unemployment," *Proceedings of American Statistical Association*, 1933; Harry Jerome, *Mechanization in Industry* (New York: 1934). Another important volume is that by Sir William H. Beveridge, *Unemployment: A Problem of Industry* (London, 1930).

and of individual incomes to rise. But in the short run, those technical improvements would necessitate readjustments which take time and may cause temporary unemployment.

In recent years, a question has often been asked: Is economic progress likely to raise or lower the proportion of the national dividend which goes to labor? One theory intended to answer this question has been formulated by Hicks.¹⁴ According to his inquiry, a technological change can affect the income imputed to a given factor of production and to other factors in various ways:

1. An increase in the supply of any factor of production will increase the absolute share (that is, the real income) accruing to that factor if the elasticity of demand for that factor is greater than unity.
2. An increase in supply of any factor will always increase the absolute share of all other factors taken together.
3. An increase in the supply of any factor will increase its relative share (that is, its proportion of the national dividend), if its "elasticity of substitution" is greater than unity.

The final outcome depends on how the marginal productivity of the given factor is affected. For the sake of simplicity, it is assumed by Hicks that only two factors, labor and capital, are used in producing a given commodity. Accordingly, improved techniques which affect both absolute and relative shares of the total product imputed to the two factors may be classified as labor-saving, capital-saving, or neutral. Labor-saving inventions are those which increase the marginal product of capital more than they increase the marginal product of labor. Conversely, capital-saving inventions increase the marginal product of capital less than that of labor. A neutral invention means that the marginal productivities of the two factors are increased in the same proportion.

Hicks's analysis is based on two assumptions. One is that in each case the system is in equilibrium and the other is that he ignores completely the possibility of increasing returns. These two assumptions limit, to a great extent, the applicability of his

¹⁴ J. R. Hicks, *Theory of Wages*, Chapter 6, "Distribution and Economic Progress," especially pp. 113-125.

theory to an evolutionary process such as industrialization. But the general principles remain valid and, if supported by empirical verification, may prove useful in suggesting the general direction of the relative importance of labor, or of any other factor of production, as a consequence of technological change.

The above discussions would apply to the production field of industry as well as to that of agriculture. However, in the latter, land as a factor of production ought to be brought in and treated with special emphasis.

B. THE SHARE OF LABOR IN AGRICULTURE

It was made clear in Chapter IV that ever since industrialization has been working appreciably, the relative importance of agriculture in the total economy of the world has been on the decrease. This section will consider the effects of technological changes on the share, both absolute and relative, of labor in this relatively ever-declining agriculture. According to the theoretical analysis made by Hicks and others, the increase in quantity of a factor of production in a closed economy will always increase the absolute share of income imputed to the factor if the elasticity of demand for it is greater than unity, and will always increase the absolute share of all other factors taken together. Whether or not the relative share of that factor will then increase, depends on whether or not its elasticity of substitution is greater than unity, or, in other words, depends on the nature of the supply of other factors. In agriculture the factors of production may be grouped as land, labor, capital, and management. In theory, management is an independent factor and should be treated separately from the others. But actually, management is often merged with either labor, or capital, or both, and hence in no way can we make a clear line of division. Therefore, our discussion will be limited to labor, capital, and land.

It need not be said that it is very difficult to measure accurately the wage income in agriculture. The total wages of labor in farm business are made up of two parts, the wages paid to hired labor and the estimated value of family and operator labor. In no way can the value of family and operator labor be estimated even to a moderate degree of accuracy. Even to meas-

ure the wages paid to hired labor on farms is not so simple a task as in the case of industrial wages. This is because farm wages usually include board and room, the value of which is no less difficult to estimate. Some difficulties will also be encountered in estimating the value of capital and the value of land.

The absolute share of labor in agriculture may be represented by total wage income. Again the United States serves as an illustration. Here I adopt a makeshift method. If, for a period of time, the absolute number of farm workers remains the same, then the trend of farm wage rates (per month) may be taken as an indication of the trend of the absolute share of labor in farm business. From 1880 to 1940 the total population of the United States has increased by 280 per cent, that is, reduced to index numbers, from 100 to 280. The percentage of farm workers in total population in the period has decreased from 50 per cent to 20 per cent. A moment of arithmetic shows that the actual number of farm workers was almost the same in 1880 and in 1940. Keeping this in mind, Table 18 shows how the farm wage

TABLE 18

INDEX NUMBERS OF THE FARM WAGE RATES IN THE UNITED STATES
(1910-14 = 100)*

Year	Rates	Year	Rates	Year	Rates
1910.....	97	1921.....	155	1935.....	103
1911.....	98	1925.....	176	1936.....	111
1915.....	103	1926.....	179	1940.....	126
1916.....	113	1930.....	167	1941.....	154
1920.....	242	1931.....	130		

* From U. S. Department of Agriculture, *Agricultural Outlook Charts*, 1944, p. 7.

rates have varied during the past several decades. The trend of farm wage rates is undoubtedly one of a gradual and slight increase. But the trend is not very clear because it was overshadowed by the cyclical fluctuations which were more violent so far as the past three decades are concerned. The period is too short to fit into a trend. The least we can say is that the ab-

solute share of labor in farm business during the first half of the present century has not shown a decrease. Most probably it has slightly increased. This seems to be in accord with Hicks's second proposition that the increase in quantity of a factor of production (capital) will always increase the absolute share of all other factors (labor and land) taken together. But his proposition applies only to a stationary state. Whether the absolute share for labor and for land will increase under a technological change remains a controversial thesis. One writer has asserted that the total effect of technological changes appears to have lowered the absolute share both of land and of labor in comparison with capital.¹⁵ The reasoning runs as follows. The effects of improvements which increase the physical productivity of the land rest largely upon the elasticity of demand and will differ with commodities. The fact that past attempts to measure demand elasticities points to a predominance of inelastic demands in agriculture suggests that the total effect of greater production per acre is to lower absolute money rents and consequently land's relative share of income.¹⁶ In view of the low elasticity of demand both for land and for labor, it is quite possible that their absolute share may not have increased, or have increased very slightly.

Whether or not the relative share of labor in agricultural income has increased during the process of industrialization commands more interest. It will show whether labor as a major factor of production has gained as much as other major factors. From the data from Agricultural Statistics and the United States Census, Heady has, for the first time, attempted an estimate concerning the relative shares of gross income in agriculture imputed to land, labor, capital, and management. Despite many statistical defects, the figures are still worth quoting because they provide some general and unmistakable indications.¹⁷ The abnormal years such as those during and immedi-

¹⁵ Earl O. Heady, "Changes in Income Distribution in Agriculture with Special Reference to Technological Progress," *Journal of Farm Economics*, August 1944, pp. 435-447.

¹⁶ Heady, p. 445.

¹⁷ Heady, p. 440, Table 2. As to the method of computation, see explanation on pp. 440-441.

ately after World War I and during the Great Depression were taken away in the above estimates. The figures are, therefore, quite representative of a normal situation in the process of industrialization. During the past three decades the relative share of labor has decreased from 53 per cent to 42 per cent. In view of the fair constancy in the share of land, it is very clear that the decrease was due almost entirely to the corresponding in-

TABLE 19

ESTIMATED RELATIVE SHARE OF GROSS INCOME OF AGRICULTURE
IMPUTED TO LAND, LABOR, CAPITAL, AND MANAGEMENT IN THE
UNITED STATES

Period	Labor	Land	Capital and management	Total
1910-14.	53.4	30.3	16.4	100.0
1924-28.	47.4	30.2	22.4	100.0
1936-40.	41.8	26.9	31.3	100.0

crease in the relative share of capital and management, which rose from 16 per cent to 31 per cent. The rate of increase in the case of capital and management was much greater than the rate of decrease in the case of labor.

Such a shift in the relative importance of labor and capital is entirely in accord with the general tendency of industrialization because, as Chapter III pointed out, industrialization may be defined as a process of "capitalization." It means a process of widening and deepening the use of capital in production. This applies to agriculture as well as to industry. In agriculture land plays a distinctively major role which deserves special attention. As I have pointed out time and again, the improvements in agriculture may be classified as those which raise the physical productivity of land, those which raise the physical productivity of labor, and those which raise both. The first category may be represented by the use of chemical fertilizers and the application of a modern plow, which increases the fertility of land. In the long run, improvements of this sort are mingled with the

land and in no way separable from it to be treated independently as capital. It is in this sense that land can maintain a constant share of total income in agriculture as improvements are introduced. Otherwise the share of land would be drastically decreased.

Theoretically, the technological advancement of this type, that is, that which increases the total output per acre of land, may either increase or decrease the absolute rent, depending upon whether the demand for the product or the group of products the land grows is elastic or inelastic. In the case where the demand is inelastic, the result is a lower money rent and consequently a smaller relative share of income for land. When the demand is elastic this type of improvement normally results in a greater absolute rent, but may or may not result in a larger relative share imputed to land. The final outcome about the relative share depends on whether or not the marginal product of land is increased by more than that of other agents used in conjunction with it. But, practically, the marginal products for different factors of production are in no way divisible.

The continuous decrease of the relative share for labor is one of the basic characteristics of the process of industrialization. To replace labor by capital (machinery) is usually considered as just what industrialization means, although according to our conception the latter covers a wider scope than this. Such a replacement comes about chiefly through the labor-saving invention as suggested by Hicks. It may also come into existence because of the more favorable marginal productivity, marginal cost ratio of capital resulting from lower interest rates, or new inventions.¹⁸ The figures in the foregoing table probably understate the declining importance of labor in agriculture, due to the discontinuous nature of the labor supply. Some family labor has always fallen into this category. Not only the elasticity of supply of family labor is low, but also the marginal product of it is very small. This accounts largely for the decline both of labor's absolute and relative share of agricultural income. Even in the case where farm labor is scarce, such as in the United States during the eighteenth and nineteenth centuries, or in a

¹⁸ Earl O. Heady, "Changes in Income Distribution," p. 442.

rural community in which no surplus of labor exists, such as in England during the several periods of agricultural reform both preceding and following the Industrial Revolution, the relative share for labor still tends to decline, although its absolute share is on the increase. The ever-increasing importance of capital in the combination of the factors of production is a universal phenomenon that characterizes the economy of modern times. So is the declining importance of labor. This has been true in any field of production.

But neither the decrease of the absolute share nor the decline of the relative share for labor implies that agricultural workers have not benefited from industrialization and the mechanization in agriculture. Despite many hardships and sufferings which the agricultural workers, especially the peasant farmers, have to bear, on the whole they have gained through the process. Their gain may be first stated in terms of money income. Statistics have shown that in England the agricultural wages increased by 22 per cent from 1880 to 1914, although the increase was smaller than the general average which rose by 38 per cent in the same period.¹⁹ In the United States the net income per farm worker rose from \$375 in 1910-1914 to \$500 in 1935-1939,²⁰ despite the fact that it is subject more severely to cyclical fluctuations than the urban-labor income. The farm workers have also benefited from the adoption of machinery because it lightens the work load in agriculture. This benefit comes from the change in the nature of farm work and is often neglected by economists for the obvious reason that it does not run in pecuniary terms. In this connection, a question has often been asked: How does the use of power machinery affect the length of the workday on farms? It has been ascertained that it does not shorten work hours during the busy season, and in some cases it even increases the working time per day.²¹

¹⁹ A. L. Bowley, *Wages and Income in the United Kingdom Since 1860*, Tables I and II, p. 6 and p. 8.

²⁰ John D. Black, *Parity, Parity, Parity*, p. 93.

²¹ In most areas of the United States, it is found that the farmers and their hired men put in 0.2 to 0.3 hour more per field day on farms with a tractor than on farms using only horses. See WPA, N.R.P. Report No. A-11, *Changes in Farm Power and Equipment: Field Implements*, by Eugene G. McKibben and others (Washington, 1939), Table A-12.

In general, it may be stated that decrease in both the absolute and the relative share of income for labor is not only technically but also economically necessary in order to bring about an effective accomplishment of mechanization in agriculture. It is only when the marginal product of capital is increased by more than other agents that capital can be profitably and effectively introduced. It is also under this condition that the structure of farm production can be reorganized. Once capital, especially in the form of machinery, is invested or installed, there will be a momentum set for its further expansion. Such a self-generating force lies intrinsically in part in the technical structure of modern production and in part in the capitalist economic system. Even in a socialist or collectivist society, the tendency will still exist because of technical reasons. The differences in the production structure make the tendency much stronger in industry than in agriculture. The greater share of capital is not necessarily always to go to capitalists. As many socialists have often argued, because capital in the last analysis is an accumulation of labor imputed in the past, the returns from capital should go to labor. This will drive us into the controversy about ownership and the distribution system, which is beyond the scope of the present essay. At the moment, we want to stress only one point. From the point of view of production, the share of labor has to decline. How to make that decline less harmful to labor in a free-enterprise society or how to make the returns from capital shared by labor at large in a collectivist regime is a matter of economic policy which will not detain us here.

C. LABOR TRANSFER FROM FARM TO FACTORY

In the preceding two sections, I have discussed both in theory and from the viewpoint of historical development the effects of industrialization on labor in general and agricultural labor in particular. But agricultural labor does not always stay on farms. Part of it will shift to factories for industrial production. And this shift is one of the characteristics of industrialization. As we have noted in the section on "The Place of Agriculture in a Total Economy" in the last chapter, the percentage of agricultural working population has been on the decrease ever since

industrialization was introduced. In the present section we shall first discuss theoretically the labor transfer from agriculture as one "industry" to industry as another "industry" and also as from one region to another region. Later it will be shown, from historical development and statistical information, how the transfer actually took place.

THEORIES RELATING TO LABOR TRANSFER BETWEEN
"INDUSTRIES" AND REGIONS

From the point of view of an "industry" producing a particular commodity, the necessary minimum payment for a factor is not the payment which will cause that factor to exist, but the payment which will cause it to take service in that particular industry rather than in another.²² Therefore, from the point of view of any industry in question, the cost of any unit of a factor is determined by the reward which that unit can earn in some other industry. A worker, an entrepreneur, or an acre of land, will be transferred to one use from others when the reward that it can earn in the one use is higher than in the others, allowing for various impediments to the movement. Thus when we are studying the supply of a factor to any one industry we are not concerned with the total supply of the factor, but with the level of earnings which is necessary in order to induce units of the factor to transfer themselves to the industry in question.²³

The price which is necessary to retain a given unit of a factor in a certain industry may be called its "transfer earnings" or "transfer price,"²⁴ since a reduction of the payment made for it below this price would cause it to be transferred elsewhere, allowing for a certain number of impediments. Any particular unit of a factor may be said to be "at the margin of transference," or to be a "marginal unit," if the earnings which it receives in the industry where it is employed are just sufficient to prevent it from transferring itself to some other use.²⁵ A unit

²² See H. D. Henderson, *Supply and Demand* (New York, 1922), pp. 94-97; and G. F. Shove, "Varying Costs and Marginal Net Products," *Economic Journal*, June 1928, p. 259.

²³ Robinson, *Economics of Imperfect Competition*, p. 104.

²⁴ Robinson, *Economics of Imperfect Competition*, p. 104.

²⁵ Henderson, p. 96.

which remains in the industry for a smaller payment than it actually receives may be called an "intra-marginal unit." In agriculture many units of a factor of production are of such a category. One of the most conspicuous examples is the externally conditioned labor that prevails in a rural community.

Now let us consider industry and agriculture as two "industries," which actually are two groups of industries. Theoretically, there must be two "transfer prices" that exist respectively in agriculture and industry. In a society where industrialization has just begun, labor transfer usually takes the direction from farm to factory. But it is only with the transfer price in agriculture that we are concerned at the present. During the initial stage of industrialization, surplus in agricultural labor is of a huge amount which makes the transfer price in agriculture so low that it is insignificant in retaining labor on farms. Therefore, forces that are effective in drawing labor from farm to factory lie almost entirely in the demand for labor by industry. In a freely competitive society and under a given state of technology, the demand curve for labor of an industry in which profits are normal is given by the curve of average net productivity.²⁶ In a society where imperfect competition prevails, as is the society we actually live in, in no way does wage tend to equal the value of the marginal physical product from the point of view of the individual employer.²⁷ And so long as free entry into trade does not exist, in no way will the marginal net productivity of labor to the individual employer tend to equal the

²⁶ See Robinson, *Economics of Imperfect Competition*, Chapter 22, "The Demand Curve for Labour of an Industry," pp. 253-264.

²⁷ According to Joan Robinson, "the amount of employment given by the monopsonist organization will be restricted to the amount at which the marginal cost of labour to the whole group is equal to its demand price for each particular type of organization. The wage will be equal to the supply price of labour, and this, in each case, will be less than the value of the marginal physical product of labour. Thus exploitation will occur." Joan Robinson, *Imperfect Competition*, pp. 294-295.

But according to Chamberlin, under monopolistic competition, not only is the wage less than the value of the marginal physical product of labor, but also are the returns to other factors of production less than their own marginal physical products. If labor is exploited according to the Pigovian definition which Joan Robinson has adopted, then all factors are necessarily exploited. See Edward Chamberlin, *Theory of Monopolistic Competition*, pp. 181-184.

average net productivity, which under perfect competition is the same to the individual as to the industry. Under whatever condition it may be, we may safely arrive at the conclusion that the demand for labor by an industry will be increased in an expansionist economy as characterized by industrialization. The new industries that are created by technological changes will further raise the demand for labor.

To what extent labor will be drawn from farm to factory depends on the relative elasticities of demand for labor in agriculture and in industry. In an expansionist economy, the greater the elasticity of demand for labor in a given industry, the larger will be the amount of labor drawn to it from the other industries, giving the demand for its product and the technical coefficients of its production. According to Marshall's analysis of joint demand, there are four propositions about the demand for a factor of production, as illustrated in the case of the demand for plasterers' labor.²⁸ First, the demand for labor will be less elastic, the less elastic is the demand for the commodity. A given proportionate reduction of wages will cause a smaller proportionate reduction in total costs, so that a given proportionate fall of wages causes a smaller increase in employment than the same proportionate fall in the price of the commodity. In the same way the demand for bricks is less elastic than the demand for houses. Second, clearly, the demand for labor will be more elastic when substitution is possible than when it is not. The third proposition is that the demand for labor will be less elastic the smaller is the proportion of total costs represented by labor. In this connection it may be stated that the demand for labor will tend to be greater than when the proportions cannot be altered.²⁹ The fourth proposition is that the elasticity of demand for labor will be smaller the smaller is the elasticity of the supply of other factors, such as capital. It may also be stated that the elasticity of demand for labor will be greater the greater is the elasticity of substitution.³⁰

²⁸ See Alfred Marshall, *Principles of Economics*, pp. 382-387. For a more detailed discussion on these four propositions, see Joan Robinson, *Economics of Imperfect Competition*, pp. 257-262.

²⁹ Robinson, *Imperfect Competition*, p. 256.

³⁰ Robinson, *Imperfect Competition*, p. 257.

From the above four propositions, it can be clearly seen that in an expansionist economy, the elasticity of demand for labor in industry is on the whole greater than that in agriculture, even given a state of prospective technology. This is so for the following reasons. First, the elasticity of demand for industrial goods is in general much greater than the elasticity of demand for agricultural goods of which most are food products. Secondly, substitution is more available in industry than in agriculture. Thirdly, considering the fact that the proportion of labor cost in total cost is usually smaller in industry than in agriculture, it may be stated that the demand for labor by industry is less elastic in this aspect. But we also know that the proportions of the factors of production are more easily subject to alteration in industry than in agriculture where land plays a major and rigid role. This would offset, though in varied degrees, the factor just considered. Finally, the supply of other factors is in general more elastic in industry than in agriculture, especially, as we have just pointed out, because land is such an important and rigid factor in agricultural production.

So far discussions have been made under the assumption that there exist no economies of large scale. In order to fit the analytical tool into our evolutionary system, economies of large scale must be introduced, together with changes in productive technique. Here we are confronting almost insurmountable difficulties. It has been argued by some writers that it is possible to represent economies of any type, simple or complicated, by a falling supply curve of capital. Every type of economy can thus be treated in terms of the simplest type where, as illustrated by Joan Robinson,³¹ a certain machine becomes cheaper as the industry expands. Thus the proposition that economies of large scale tend to make the demand curve for labor more elastic is of perfectly general application. It has been stated above that when substitution of factors is not possible the elasticity of demand for labor must be less than the elasticity of demand for the commodity, unless no factors other than labor are employed. Now it becomes clear that if there are economies of large scale in industry it is possible that the demand for labor should have

³¹ Robinson, *Imperfect Competition*, pp. 262-263.

an elasticity as great or even greater than the elasticity of demand for the commodity, even though there is no substitution.³² When technological changes are introduced, new products are created, and correspondingly new industries are established, it is more likely that the elasticity of demand for labor in industry at large will tend to be even greater than in agriculture. In an expansionist process like industrialization, it will have far-reaching effects on the labor transfer from farm to factory. But it must be recognized that the elasticity of demand for labor in industry, tending to be greater than that in agriculture, does not imply that within the industry the elasticity of substitution of labor for capital is greater than that of capital for labor. The latter is a different issue. Also labor organization in industry, such as the trade union, actually has made the wage rate and employment more rigid. This has, of course, offset the trend in which the elasticity of demand for labor in industry tends to be ever greater than in agriculture.

Transfer of labor from farm to factory may be viewed as movement of a factor of production between two regions. In theory, the international movement of a factor of production may be considered as essentially not different from the interregional movement of the factor within a country. But in practice, the institutional obstacles between countries are so much greater and more diversified than those between regions in a given country that they necessitate clear distinction and separate treatment. This, however, does not imply that the method of analysis for them is entirely different. On the contrary, as Black has said, the major portion of that body of analysis which is ordinarily presented as international trade theory frequently has equal application to interregional trade within a country.³³

Only in recent decades have writers begun to consider and treat factor movements as an alternative to trade, which consists only of commodity movements. The orthodox treaties on trade have neglected almost completely the international movement of labor and capital but assumed a perfect mobility for

³² Robinson, *Imperfect Competition*, p. 263.

³³ John D. Black, "Interregional Analysis with Particular Reference to Agriculture," in *Explorations in Economics* (New York and London, 1936), p. 200.

these factors within a country. Neither of these assumptions corresponds to reality.³⁴ Despite factor movement and commodity movement being alternatives, their differences still exist and are to be clearly recognized. The stimulus which makes laborers overcome the obstacles is chiefly a desire to receive a higher wage. But the difference in price sufficient to induce a transfer of labor is insufficient to call forth a greater transfer. Thus, if the height of the obstacle is measured by the stimulus necessary to overcome it, it is clear that different laborers meet obstacles of differing heights. In this respect there is a lack of analogy to the obstacles to commodity movements such as difficulties of transportation and duties, which from an economic point of view appear as costs of transfer.³⁵ The exchange of commodities between regions or countries may exist with or without an accompanying movement of factors of production. Theoretically, it is conceivable that movement of a factor may take place between two regions without any commodity exchange existing between them. But, practically, this is most improbable. For all practical purposes, it may well be assumed that either commodities alone or both commodities and factors move between the various regions. It should also be borne in mind that the distinction between a commodity and a factor is not a clear-cut one. This is especially true in the case of capital. In dealing with labor no such difficulty will be encountered.

But transfer of labor from farm to factory cannot be identified with the interregional movement of a factor of production and hence treated simply by the static interregional analysis. The former involves technological changes which are assumed absent in the orthodox international and interregional trade theories. Because it involves technological changes, the value of the marginal product of labor is always changing and is in no way comparable between farm and factory. What we can do for our inquiry is either to give a prospective state of technology

³⁴ See John H. Williams, "The Theory of International Trade Reconsidered," *Economics Journal*, June 1929.

³⁵ Bertil Ohlin, *Interregional and International Trade* (Cambridge, 1933), p. 168. For a detailed and interesting discussion, see Chapter 9, "Interregional Factor Movements and Their Relation to Commodity Movements," pp. 167-182.

and then apply the interregional analysis, or to employ the static interregional analysis merely for setting the stage.

DISPLACEMENT OF FARM LABOR BY MACHINERY

Mechanization in agriculture, as displayed in the experience of some countries, has lightened the load of farm work, and in some cases has shortened the working time per day. But more important than anything else, it has displaced, in different degrees with different types of farming, the farm labor. Such displacement has been of great concern to farm labor. The displacement may be "absolute," where the labor force in any line of work is decreased; or it may be only "relative," where the rate of increase in the number of laborers employed falls below the rate of increase of laborers employed in industry and other fields of production.³⁶

The absolute displacement of farm labor is best expressed by the decrease in the absolute number of persons engaged in agriculture. The New England area of the United States furnishes a good example of it. In 1800 the population ten years of age and over engaged in agriculture numbered 304,679; in 1890, 304,448; and in 1900 the number was only 287,829.³⁷ This decrease was not due to a decadence of agriculture in those areas, for the physical volume of agricultural production was much greater in 1900 than in 1880. In the main it must have been due to the introduction of machinery as indicated by the reported valuation of agricultural implements and machines, which increased from \$1.68 per acre of improved land in 1880, to \$4.49 per acre in 1900.³⁸ But in other areas of the country, there has not been shown any absolute displacement and, instead, the absolute number of farm workers has increased during the period under our review, a period representing one of the highest stages in farm mechanization. For example, in the seven leading cereal producing states, the so-called Middle West, the number

³⁶ A detailed discussion on the displacement of farm labor by machinery will be found in H. W. Quaintance's *The Influence of Farm Machinery on Production and Labor*, (New York, 1904), Part III, pp. 30-42, which is, in fact, the first systematic analysis made on the subject.

³⁷ From the eleventh and twelfth United States censuses on agriculture.

³⁸ From U. S. *Twelfth Census*; Agriculture I, p. 698.

of agricultural laborers was 352,565 in 1880; slightly increased to 359,894 in 1890; but further increased by a great amount to 612,418 in 1900.³⁹ The total farm labor force of the United States first showed an annual increase from 1870 up to 1910, and since then it has shown an annual decrease. It may be said that only after 1910 did the absolute displacement of labor in agriculture for the United States as a whole take place. This is clearly shown in Table 20. Thus in an economic society whether

TABLE 20

CHANGE IN FARM LABOR FORCE IN THE UNITED STATES*

Year	Number†	Index	Per cent change‡
1870.....	6,849,772	100	...
1880.....	8,584,810	125	25
1890.....	9,938,373	145	16
1900.....	10,911,998	159	10
1910.....	11,591,767	169	6
1920.....	11,448,770	167	-1
1930.....	10,471,998	153	-9
1940.....	9,162,574	134	-13

* From the sixteenth census of the United States. See United States Bureau of the Census, *Population*, Series P-9, No. 11, December, 1944.

† Including persons ten years old and over.

‡ From preceding decade.

or not absolute displacement occurs depends on many factors. Among them, to what extent a surplus in agricultural labor has been accumulated is most important, given a state of technology.

It need not be said that the absolute displacement varies more particularly with the technological change. The attraction of industry and of other occupations in the cities is often more forceful in determining the presence and the extent of the absolute displacement on farms than the introduction of farm technology alone. Because, without the attraction from other fields, farm workers would have to stay on farms under the form of

³⁹ From the eleventh and twelfth censuses of the United States on agriculture.

“under-employment” even after a new machine is introduced. This is especially true with family labor, while the hired labor may be made partly unemployed and hence more easily attracted away.

The absolute displacement of labor differs also with different types of farming. Although in the long run the amount of surplus labor in different branches of farming will tend to be equal, the introduction of new technology, nevertheless, differs widely with types of farming both in kind and in degree. The amount of labor displaced hence varies accordingly. Here again we take the United States for illustration. According to estimates, changes in the average annual labor requirements for three main types of farming during the past three decades are shown in Table 21.⁴⁰ It is clear that the over-all average hours required

TABLE 21

AVERAGE ANNUAL LABOR INPUTS FOR DIFFERENT TYPES OF FARMING
IN THE UNITED STATES
(in million hours)

Year	Major crops*	Truck crops†	Livestock‡	Total
1909-13.....	7,470	200	3,816	11,486
1917-21.....	7,184	250	4,387	11,821
1927-31.....	6,724	340	4,883	11,947
1932-36.....	5,575	394	5,159	11,128

* The major crops include wheat, corn, oats, potatoes, and cotton.

† The truck crops contain fifteen vegetable crops.

‡ Three livestock enterprises are included here. They are dairy cattle, chickens, and hogs.

for the three types of farming per year have remained fairly constant, barring the changes due to the cyclical fluctuations in the period. But the situation is different with different types of farming. The group of major crops has shown a continuous decrease in the labor requirement, which must have resulted in the absolute displacement of labor. On the other hand, the truck

⁴⁰ See reports on *Changes in Technology and Labor Requirements in Crop Production* as follows: WPA—N.R.P. Reports Nos. A-4, *Potatoes*; A-5, *Corn*; A-10, *Wheat and Oats*; A-7, *Cotton*; A-12, *Vegetable Crops*; and report on *Changes in Technology and Labor Requirements in Dairying*, 1939.

crop group and the livestock enterprises have shown an increase in labor requirement even without interruption during the depression.

In view of the fact that production in these three groups of farming has increased during the period under concern, the difference in labor requirements may be accounted for by the following reasons. First, the extent of mechanization in major crops was far greater than in the other two groups. As shown in Table 22, the man-hours required per unit of product and per unit of the major factor of production have been gradually reduced in cereal as well as in cotton production, while they have shown little change in vegetable-farming and livestock-keeping enterprises.

Such a reduction in man-hours required per unit of product and of factor in wheat and cotton was largely due to the intro-

TABLE 22

MAN-HOURS INPUTS OF DIFFERENT TYPES OF
FARMING IN THE UNITED STATES*

PER UNIT OF PRODUCT:

Year	Wheat per bushel	Cotton per bale	Vegetables	Milk per 1000 lbs.
1909-13.....	0.89	271	...	35.5
1917-21.....	0.77	275	...	36.5
1927-31.....	0.46	238	...	30.7
1932-36.....	0.41	218	...	33.0

PER UNIT OF THE MAJOR FACTOR

Year	Wheat per acre	Cotton per acre	Vegetables per acre	Milk per cow
1909-13.....	12.7	105	...	135
1917-21.....	10.3	95	145	138
1927-31.....	6.7	85	141	139
1932-36.....	6.1	88	135	140

* From the various reports as quoted above concerning wheat, cotton, vegetable crops, and dairy products.

duction of machinery. The second reason is that production was increased at a greater speed for truck crops and livestock than for major crops. This is mainly because demand has been increased more for protective food, such as vegetables and animal products, than for cereals, and more for woolen cloth than for cotton pieces. During the great expansion in truck farming and in livestock enterprises these groups have not only retained their own labor that otherwise would have been partly displaced by machinery and the other new devices, but have also absorbed in part the labor displaced by new techniques in other farming enterprises. This accounts for a fairly stable situation revealed in the whole picture of labor requirement and, accordingly, of the absolute displacement of labor.

The relative displacement of labor has shown a different picture. It has taken place in a remarkable degree during the last hundred years so far as the several leading industrial countries are concerned. The relative displacement of labor is revealed by the comparison of the change in the percentage of working population in agriculture with that in other production fields. Analyses of this appeared in Chapter II, dealing with the occupational shift of population, and in Chapter IV, discussing the relative importance of agriculture. However here it is necessary only to point out that the percentage of working population in agriculture has decreased most drastically in Great Britain, Germany, and the United States, respectively in their own periods of industrial revolution. In the case of the United States, the working population in agriculture has decreased from 70.8 per cent in 1830 to 22.5 per cent in 1930. The total population has more than trebled during the same period. Where this great amount of working population released from the farm has gone is a subject of our next concern.

ATTRACTION FOR AND ABSORPTION OF FARM LABOR BY INDUSTRY

At the beginning of this discussion, I noted that during the process of industrialization, not all the farm workers are drawn to the cities just because of their being displaced by machinery. As Black has shown, the process by which the excess labor sup-

ply of the farms is drawn to the cities is of two patterns, to which he applied the simple words "pull" and "push."⁴¹ In normal years of industrial development, a considerable portion of the young people on the farm are each year pulled to the city by the prospects of higher earnings and better living. Of course more are pulled to the city in good times than in bad. Usually many more have gone to the city seeking for jobs than have been able to find them. When the "push" operates, workers leave the farm because they cannot make a living there any more. This happens when a machine is introduced to displace the worker. These two forces, pulling and pushing, are always working together. It is very difficult to make a distinction between the workers who are pulled to the city and those who are pushed from the farm. Estimates have been made that in the United States 5,000,000 farm workers moved to the city between 1920 and 1930. Part of them went back to the farm during the depression.

As the first section of this chapter has briefly shown, the movement of workers from farm to factory is the movement of a factor of production — labor — from one region to another. The effectiveness of the movement depends upon the difference in the price for the factor in two regions, which must be great enough to overcome the obstacles met in the transfer. This is true both within a country and between different countries. The migration of labor force from European countries to the United States and that from Eastern to Western Europe during the second half of the nineteenth century illustrates the movement between countries, as shown in Table 23.

In the case of the United States, Hourwich has stated, after a detailed analysis, that in the short run the immigration movement responds promptly to the business situation of the United States, while in the long run it bears an almost constant relation to her population.⁴² This statement may be accepted, allowing

⁴¹ John D. Black, "Factors Conditioning Innovations in Agriculture," *Mechanical Engineering*, March 1945.

⁴² Hourwich, *Immigration and Labour*, p. 93 and p. 101. The percentages of immigrants for every twenty years following to the total population of the United States were: 1850, 21.2 per cent; 1870, 20.9 per cent; 1890, 19.9 per cent (p. 101).

TABLE 23
MIGRATION OF LABOR FORCE BETWEEN COUNTRIES*

Decade	From Europe to U. S. A.	Year	From Russian Poland to Germany
1850-1860.....	2,488,000	1890.....	17,000
1860-1870.....	2,124,000	1900.....	119,000
1870-1880.....	2,272,000	1901.....	140,000
1880-1890.....	4,737,000	1902.....	136,000
1890-1900.....	3,539,000	1903.....	142,000
1900-1910.....	8,213,000	1904.....	138,000

* From Isaac A. Hourwich, *Immigration and Labour—The Economic Aspects of European Immigration to the United States* (New York and London, 1912), p. 88, Table 7, and p. 181, Table 44.

only for the artificial limitations put on both emigration and immigration.

This migration of labor force between countries is, of course, not to be identified with the transfer of labor force from farm to factory. Because, obviously, not all the immigrants did join the industrial occupations. As a matter of fact, a majority of them were unskilled laborers and went to work on farms. This is also shown by the immigration statistics of the United States.

TABLE 24
PERCENTAGE DISTRIBUTION OF IMMIGRANTS BY OCCUPATION IN THE
UNITED STATES*

Occupation	1861- 1870	1871- 1880	1881- 1890	1891- 1900	1901- 1910
Professional.....	0.8	1.4	1.1	0.9	1.5
Skilled.....	24.0	23.1	20.4	20.1	20.2
Agricultural Pursuits..	17.6	18.2	14.0	11.4	24.3
Unskilled Labourers...	42.4	41.9	50.2	47.0	34.8
Servants.....	7.2	7.7	9.4	15.1	14.1
Others.....	8.0	7.7	9.4	5.5	5.1
Total.....	100.0	100.0	100.0	100.0	100.0

* For sources of information, see Hourwich, Appendix, p. 503.

Among the immigrants, most of the skilled labor went to factory. This group amounted to only one-fifth to one-fourth of the total. Agricultural workers and unskilled laborers constituted around 60 per cent of the total. From the experience of the United States and Germany it can be seen that the immigrants usually took the place of the native farm workers who had already shifted to industrial and other occupations. In Germany, about 95 per cent of the temporary immigrants from Russian Poland found employment as agricultural laborers. The demand for them was the direct result of the movement of Polish peasants from rural districts of Prussian Poland to the great industrial cities of Germany and particularly to the coal mining districts.⁴³ Thus we may say that though migration of labor force between countries is not on the whole the movement from farm to factory, but it has helped to strengthen and hasten the latter in the country where immigrants entered.

Transfer of labor from farm to factory is motivated basically by a higher money wage in the city than that in the country. The difference in real wage may not be as great as the difference in money wage, owing mainly to a higher cost of living in urban areas. But in general workers are more concerned with the money wage because it has direct and immediate interest. In addition to differences in money wage, there are other factors, mostly noneconomical, that pull workers from villages to towns and cities. These factors are, of course, outside the scope of our study. So far as money wage is concerned, the factory hourly earnings have advanced at a greater speed than the farm wage rates. Table 25 shows the situation of the United States in the past three decades, a period representing the later stage of industrialization.

It is clear, from the table, that compared with the farm wage rates, the factory hourly earnings have not only shown an advance at a greater rate, but also and more particularly shown a situation of higher stability. This stability is what is commonly called the "rigidity" of the industrial wage rate resulting largely from trade union's ever-increasing bargaining power. The unfavorable situation in money wage on the farm, however, is

⁴³ Hourwich, p. 182.

partly compensated by a more stable employment. Farm workers are in general only "underemployed," but not "unemployed." Thus by keeping a more or less stable employment, the farm wage rates have to vary with the cyclical fluctuations. In industry, the wage rate is much more rigid. Thus when depression comes, a larger amount of "genuine" unemployment is bound to occur. Even usually, some sort of "frictional" un-

TABLE 25
INDEX NUMBERS OF FARM WAGE RATES AND FACTORY HOURLY
EARNINGS IN THE UNITED STATES*
(1910-14 = 100)

Year	Farm wage rates	Factory hourly earnings
1910.....	97	94
1915.....	103	108
1920.....	242	273
1925.....	176	257
1930.....	167	261
1935.....	103	264
1940.....	126	318

* The index numbers are based on the data supplied by the United States Department of Agriculture, Bureau of Agricultural Economics, and by the United States Department of Labor, Bureau of Labor Statistics.

employment always exists. Allowing for these cyclical fluctuations, the long trend is and must be in favor of the factory hourly earnings in the process of industrialization. It is necessary in order to make effective the movement of labor from farm to factory. To hold the trend, as shown in the "parity" policy of the United States,⁴⁴ is theoretically not sound. The practical problem is how to adjust the labor transfer so as to reduce the inevitable sufferings of farm workers to a minimum.

Transfer of labor from farm to factory is by no means direct, immediate, or smooth. First, laborers in rural industry often have the chance to be the first transferred. As we have pointed

⁴⁴ For a detailed discussion on the parity policy of the United States, see John D. Black, *Parity, Parity, Parity*, especially Chapters 5-9, and Chapter 14.

out in the last section of Chapter III, until industrialization reaches a higher stage, rural industry is organically inseparable from agriculture, although functionally the two may be kept apart. Workers in rural industry are as a rule recruited from farm family and are mostly "externally" conditioned. Thus they are more easily transferred. Besides, they are more skilled than those merely working on the farm, so far as industrial technique is concerned. Secondly, the young people of the rural family usually constitute a great part of the labor transferring to the city, while the old folks generally stay on the farm. These young people receive their education or training in the city, and when they finish, they most probably will not return to the farm. This aspect has been well recognized by some writers.⁴⁵ Finally, it may be said that the labor transfer is not a "once-for-all" step. Many farm workers move to the city only temporarily, and most frequently during a certain season. Others try to stay as long in the city as possible, but when depression comes they will return to their former farm work. It is a long and hard step for a farm worker to settle down in the city and stand firmly on his new employment.

It has been shown on several occasions that during the past hundred years the percentage of working population in agriculture in some highly industrialized countries has been rapidly decreasing. The total population in the same period has increased by several times. Undoubtedly this increased population, together with that released from farm work, have been absorbed by industry, commerce, transport, and other occupations. How much each of these fields has absorbed, especially the portion obtained by industry alone, will be our present concern. Table 26, in which the United States is again taken as an example, is illustrative of this aspect.

Table 26 clearly shows that the percentage of working popu-

⁴⁵ For example, as one writer has well said, "the full tendency of farm people to shift to non-farm pursuits is not reflected in the occupational shift of farm operators. In 1940 farm operators were 48 years old on the average. By that age one's habits are usually so stabilized and family responsibilities so great as to put the brakes on any ready impulse to shift into a new life work. This is not the case with younger age group." See John M. Brewster, "Farm Technological Advance and Total Population Growth," *Journal of Farm Economics*, August 1945, p. 523.

lation in mining and in domestic, personal, and professional services has only slightly increased, while the percentage in manufacture and building and in trade, transport, and communication, which are the fields considered as industry in this essay, has greatly advanced. There was a slight setback of the general tendency after the Great Depression, as indicated in the

TABLE 26

PERCENTAGES OF WORKING POPULATION IN THE UNITED STATES*†

Year	Agriculture, forestry, fishing	Mining	Manufacture and building	Trade, transport, communi- cation	Domestic, personal, professional
1830	70.8	0.3	13.3	3.1	12.5
1840	68.8	0.3	13.3	3.8	12.3
1850	64.8	1.2	14.6	5.4	12.2
1860	60.2	1.6	16.4	7.4	12.4
1870	53.8	1.4	18.3	10.4	13.1
1880	49.4	1.5	21.2	12.2	12.8
1890	42.6	1.7	24.0	15.7	14.4
1900	37.4	2.0	25.6	18.7	15.8
1910	31.9	2.6	27.0	21.3	15.0
1920	26.7	2.6	28.4	25.0	21.2
1930	22.5	2.4	30.6	24.6	21.6
1935	25.4	1.8	27.0	22.1	23.7

* From Colin Clark, *Conditions of Economic Progress* (London, 1940), table on p. 185.

† Census without deduction of unemployed, except the figures for 1935, which include the population actually in work.

1935 figures. But very soon forces for the setback were dispelled by the wartime boom, and the tendency renewed its momentum. Whether the tendency will continue during the post-war period is highly conjectural. For the present, we may say that in a more or less mature economy like that of the United States and Great Britain, unless distribution of income is greatly modified, the tendency will most likely not continue, at least will not operate at so great a rate as it did in the early phases of industrialization. Trade between countries will undoubtedly

sustain the tendency. But the extent to which it will contribute is hard to predict.

At the transfer of labor from farm to factory, the role played by women workers is also to be mentioned. A noticeable fact is that ever since industrialization began, their proportion has increased both in agriculture as well as in other fields. In the United States, the absolute number of man workers engaged in agriculture has increased by 32 per cent from 1880 to 1900, while that of woman workers by 64 per cent.⁴⁶ A large proportion of women workers have departed from domestic and personal services and joined the work of direct production. When men workers left the farm, many women took their jobs. This is especially true on a family farm.

⁴⁶ From Quaintance, *The Influence of Farm Machinery on Production and Labour*, table on p. 36.

CHAPTER VI

INDUSTRIALIZATION IN AN INDUSTRIAL COUNTRY

AN AGRICULTURAL COUNTRY, or even an agricultural region within a political sovereignty, tends to "industrialize" itself, if given political independence and stability, the necessary resources and initial capital, and the opportunity to acquire modern skill. Industrialization by our definition is a process in which the strategical production functions are changing and in which the economic gains of industrial progress are created and realized. A country, after being industrialized in this sense, may either become one in which manufacturing industries are predominant both in terms of working population and of national income, or remain one in which agriculture is dominant, or pass into the type in which the manufacturing industries and agricultural enterprises maintain a fair balance. The first type may be exemplified by Great Britain, the United States, and Germany; the second by Denmark, Japan, and Italy; and the third by France, Canada, and Australia. It is in this sense, and only in this sense, that every agricultural country will tend to industrialize herself in order to share the benefits of economic progress. In the long run, however, countries of the second type may pass into the third; and, together with those of the third, into the first. The determining factor is technology; and the limitational factors are resources and population.

The essential feature of industrialization in our concept is, as has been pointed out time and again, the change of production functions in strategical fields. These fields include power, transport, machine tools, iron and steel, and some other basic industries. They represent part of the so-called "secondary" production, and part of the so-called "tertiary" production. They affect agricultural enterprises as well as manufacturing

industries, though the effects on these two lines of production are of different category and magnitude. A country undergoing industrialization may or may not pass through the stage in which manufacturing industries are predominantly developed. It is only partially true to say that along with economic progress, the working population moves first from agriculture to manufacture, and then from manufacture to commerce and services.¹ In addition to that type of movement, other types exist as well. The working population may move from agriculture directly to commerce, transport, and other services, or simultaneously to these fields and to manufacture. It is also over-simplifying modern economy to state that it has passed from the primary producing stage to the manufacturing or industrial or secondary producing stage, and therefrom to the tertiary stage in which we are now supposed to stay.² These three fields of production functions are always interwoven and interdependent and can never be clearly separated. It would be equally false to assert that the world economy has to pass through these three stages in order. For example, the commercial expansion in the fifteenth to the seventeenth centuries did precede, and to some extent did serve as a stimulating factor for, the industrial expansion in the following periods.

Thus industrialization in any particular agricultural country does not necessarily imply that in that country the manufacturing industries will become dominant. A country may be considered industrialized when her agricultural production remains dominant or equally as important as the manufacturing industries, only if the transport and power services have been modernized and farming is "enterprised" on the scientific line. In this chapter, problems involved in the industrialization of an agricultural country are to be discussed. With the prospective

¹ Clark has taken the movement of working population from agriculture to manufacture, and from manufacture to commerce and services as the most important concomitant of economic progress. In my opinion, this is only one of the types of the movement of labor forces. See Colin Clark, *Conditions of Economic Progress*, Chapter 5, pp. 176-219.

² In this connection, Fisher seems to have followed the tradition of Bücher's stage theory, when he put the development of world economy into the primary, secondary, and tertiary, stages. See A. G. B. Fisher, *The Clash of Progress and Security* (London, 1935), pp. 25-29.

industrialization of China in mind the implications of international economic relations will be brought out for discussion.

A. AGRICULTURE AND THE INDUSTRIALIZATION OF CHINA³

A BRIEF INTERPRETATION

The industrialization of China began more than three decades ago,⁴ but its effect is in no way appreciable, as far as the raising of the Chinese standard of living is concerned. The reasons for this are many, but only the economic ones concern us here. China first appeared to the Western powers and later to Japan merely as a market for industrial goods and as a source of supply for raw materials. These are the basic characteristics of a colonial economy, which prevailed, only in a different degree, with regard to America in the Colonial period and lately with South Africa, India, and the Southern Pacific areas. The case of China differs from that of these colonies only in that, during the period from her first contact with Western powers and later with Japan to the outbreak of the present Sino-Japanese War, she maintained political independence that gave her more or less a free hand to formulate her economic policies. But the opening of free ports, the establishment of foreign concessions in some large cities, and the granting of the right of inland

³ Part of the discussion in this section has been published in my article entitled "Role of Agriculture in China's Industrialisation," which appears in the *National Reconstruction Journal*, China Institute in America, New York, October 1945, pp. 50-59.

⁴ Apart from the state arsenals, sizable industry hardly existed in China before 1890. The first cotton mills were established in that year. A railway line was built between 1880 and 1894, but railway construction on a substantial scale did not begin till after the Sino-Japanese War of 1894. It should be noted that before 1890, there had already existed some industrial firms on modern lines. The first steamship was built by a Chinese company in 1862. The China Merchants Steam Navigation Co. was organized in 1872. The first rice-cleaning mill was established in Shanghai in 1863, the first silk filature in 1873, the first modern coal mine in 1878, and the first iron and steel works in 1890. For further factual informations, the reader is referred to H. D. Fong, *China's Industrialization: A Statistical Survey* (Shanghai, 1931).

The present writer takes the view, however, that only with the start of World War I, did industrialization on some substantial scale really begin to take place in China. For the first time since her contact with foreign powers, China obtained a chance, though very short, to establish and develop her own industries while other powers were busy with war.

water navigation to the Great Powers gave foreign industrial goods further advantages over Chinese products, in addition to those which were due to low costs because of mass production and modern marketing organizations.⁵ The dumping policy employed by some countries made the situation in China even worse. Moreover, most foreign goods enjoyed the advantages of paying only a small amount of customs duty and of moving freely into the interior, when transportation facilities were available, whereas domestic goods had to pay various kinds of charges in their movements from one place to another. In such circumstances, it is very difficult for any infant industry to have a healthy growth. Even for free competition and free trade we would like to see a situation in which domestic infant industries are put on an equal footing with foreign ones. Indeed, both from a theoretical and an historical point of view, domestic infant industries ought to be given special advantages if a successful start is to be made.

The interregional barriers and poor transportation facilities within China constitute another group of obstacles that have made it very difficult for the free movement of commodities and the factors of production. For a long time they have stood in the way of the modern industrialization of China. Obstacles of this kind have also tended to offset any favorable chances for agricultural improvements that might otherwise have been made. For instance, during the period between the end of the first world war and the outbreak of the second, imports of rice and other cereals from Burma and Indo-China by way of Hong Kong were consumed mostly in big cities like Shanghai, Canton, and Foochow and amounted to vast quantities annually, in some years even ranking first among China's imported articles. But during the same period, there was al-

⁵ As Tawney said some time ago, "it is still the case that over one-quarter of China's railway mileage, over three-quarters of her iron ore, mines producing more than half her output of coal, more than half the capital invested in cotton mills, and a smaller but not negligible proportion of that invested in oil mills, flour mills, tobacco factories, motor factories and banks is in the hands of foreigners. Dr. Sun Yat-Sen's description of China as a colony is, from an economic point of view, not inappropriate." See R. H. Tawney, *Land and Labour in China* (New York, 1932), p. 129.

ways a surplus of rice in the interior provinces of Hunan, Kiangsi, Anhwei, and Szechwan, which could not be profitably brought into the coastal consumption centers, due to the lack of an adequate transportation system and the existence of interregional barriers, mostly in the form of local taxes.⁶ This took away from farmers any incentive in the form of cash income to increase and improve their agricultural output, and more obviously, to raise their standard of living. On the other hand, it is also clear that payments for the importation of rice and other cereals could have been saved and used for the importation of machinery and the fertilizers which are vital for a modern agriculture.

In time perhaps such institutional obstacles may disappear. The hindrances originating in poor transportation facilities are likely to exist for a fairly long period. Other obstacles which are rooted deeply in the social structure such as farm consolidation, improvement of the tenure system, and industrialization in general,⁷ will also have to be taken into account, although discussion of them will not be presented in this essay.

ROLE OF AGRICULTURE IN INDUSTRIALIZATION

It is very difficult to estimate the role that agriculture would play in the process of industrialization, because, according to our concept, agriculture itself is involved in and is intrinsically part of the process. In any economy in which general interdependence prevails, such a difficulty is encountered in estimating the role of any manufacturing industry. Nevertheless, a discussion based upon the functional division is not entirely impossible, though a quantitative comparison of different functions is by no means always justified. It is under this consideration and the recognition of the limitations that some aspects

⁶ Statistical findings on this problem may be found in a series of monographs on China's food markets published by the Institute of Social Sciences, Academia Sinica. The present writer is one of those who has undertaken the projects and contributed to the monographs. Discussions may also be found in the author's *China's Food Problem*, Mimeographed (Washington, 1945).

⁷ The reader is referred to John E. Orchard, "The Social Background of Oriental Industrialization — Its Significance in International Trade," in *Exploration in Economics*, pp. 120-130.

of the present problem may be envisaged and brought out for a brief discussion.

First, it may be said that, because of the low income-elasticity of the demand for food, agriculture cannot escape playing a somewhat declining role, as industrialization reaches the point of obtaining a "reasonable" standard of living for the people. Up to that point the demand for food increases as income grows but thereafter the demand for food decreases relatively as incomes further rise. This will be true in China as it is true with many countries which have already been industrialized. The coming into being of such a situation, as I have pointed out in Chapter II, is the double operation of the famous Engel's Law and the fundamental psychological law which has been fruitfully used by Lord Keynes. As incomes increase, expenditure will increase but at a slower rate, and the proportion going for food will be even smaller. This, however, does not mean that agricultural activity will actually be on the decline; what it does mean is that the relative share of agriculture in terms of national output or national income will tend to decrease, while the absolute amount of agricultural activity may and most probably will keep on expanding.⁸ During the initial stages of industrialization, the demand for food in the lower-income groups will be so high that it will take a great effort on the part of farmers to increase agricultural production. As industrialization increases and a shift in the demand for food — from cereals to animal products — takes place, the farming system will, therefore, be compelled to increase the productivity of the land per acre as well as per man. There will be no fear of a surplus of food production, even taking into consideration the rapid progress of farm technology, if a good and just system for distribution of income can be instituted.

Secondly, it should be recognized that in the process of the industrialization of China, agriculture will play only a passive role. Theoretically, as well as historically, any appreciable agricultural improvements along the line of scientific farming presuppose the existence of an industrial development in the

⁸ See discussions of Chapter IV, Section E, Place of Agriculture in Total Economy.

basic and strategical fields. That is because, on the one hand, only industrial development and transport improvements can create and extend the market for agricultural products; and, on the other hand, only modern industries can supply agricultural enterprises with the equipment necessary for scientific farming. The development of agriculture in Denmark could hardly have reached its present level had that country not had a highly industrialized country like England standing by her and maintaining close economic relations with her. This has also been true for the United States, except that agricultural development here has depended more on the development of native industries, because a better balance has existed between agricultural and industrial resources. A more conspicuous example is that of Soviet Russia, where agricultural improvements on a scientific basis did not take place until industrial development along basic lines had reached an appreciable extent.⁹ All these examples support our case. This must be borne in mind when we are considering the problem under present discussion, as well as the problem of coördinating agriculture and industry, which will become more urgent in China as industrialization gets fully under way.

Finally, it has been asserted that agriculture may, through the export of its products, help to start industrialization. For decades agricultural products, such as wood-oil and tea, have ranked first among the export items in China's foreign trade. It is obvious that this export will be used to discharge in part the obligation and indebtedness incurred by the import of machinery and other manufactured goods. But the total amount of the export will be too small compared with the huge amount of imports necessary for the effective start of industrialization. To what degree the export of agricultural products will be extended depends upon the income-elasticity of the demand for them and the competition coming from other countries, as in the case of tea, for example, as well as the increase in the substitution of synthetic products now being developed in other

⁹ In Soviet Russia, power from draft animals had declined from 77.8 per cent in 1932 to 34.4 per cent in 1937, the rest representing the power coming chiefly from tractors, combines, and trucks. See A. Yugow, *Russia's Economic Front for War and Peace*, p. 49.

countries, as in the case of wood-oil. Owing to the fact that the income-elasticity of the demand for most agricultural products is low; and in view of the additional fact that substitution is being increasingly made for agricultural products, either by transplanting or by synthetic processes in the importing countries,¹⁰ the expandability of China's agricultural exports will probably be small. Ways and means for initiating industrialization, therefore, must be found, in large part, by means of other channels.

POSSIBLE ADJUSTMENTS IN AGRICULTURE

The possible adjustments that will take place in agriculture during the process of industrialization depend on many factors, some of which are not within the economic domain. Among them the government policy in regard to the allocation of resources and the distribution of income is most important and has direct effect on the types of adjustments. Under the same set of assumptions mentioned at the outset of the present section, we shall approach the problem from the different aspects of the interdependence of agriculture and industry as we have fully discussed in Chapter II, except that the factor of technology will be introduced here.

In the first place, it may be stated with confidence that agriculture will continue to be the chief source of China's food supply. But the agriculture in that country will face some pressing problems, and adjustments must be made accordingly during the process of her economic transformation. Part of the rural population will be shifted to commercial and industrial centers, and hence there will be fewer agricultural workers to produce the same or even a greater amount of food than formerly. Moreover, as the experience of various industrialized countries has shown, the growth of population in the initial stages of industrialization is most likely to be more rapid than usual. Therefore, the demand for food is bound to be greater at this stage. Furthermore, as industrialization continues, there will be a stage at which people's incomes are raised and this

¹⁰ Transplanting is best exemplified by the planting of tung oil trees in the United States during recent years.

will exercise a definite influence on the demand for food. In that case, better food will be more in demand. This would mean, for example, that meat would supplement or be a substitute for cereals. Such a shift in the demand for food will have an immense bearing on the reorientation of the types of farming, which is our primary concern.

As the discussion in Chapter II indicated, there are two aspects of the increase in the demand for food, the causes and effects of which are different and have often been confused. The increase in the demand for food may be due merely to the natural growth of population, which, under the condition that the productivity of land cannot be raised or is raised at too slow a rate, will lead to the growing of "heavy-yielding" crops. The increased demand for food may be due also to the rise in people's incomes. In this case, better food will be in demand, and a shift from crop farming to pasturing and feed farming for animals will likely follow. During the process of industrialization, the general tendency will be a change from the first type to the second type of demand for food. This has been true of many highly industrialized countries in Europe. In China, however, it will not be necessary, even for a long period to come, to turn crop farms into pasture or grassland, or rice farms into corn-growing land. There are many areas in the northwest, southwest, and southeast of China that have remained uncultivated and can in the future be used for pasture or grassland, only if transport facilities are extended to these areas and markets are created for their products. No less important in this connection is the condition that capital for cattle breeding and raising should be available. In areas like the Yangtze Valley and those around the Yellow River and farther north in Manchuria, where the density of population is higher than in the areas previously mentioned, if productivity in crop farming can be increased, some portion of the land would be more profitably used for hog and poultry raising than is now possible. Only when both productivity in agriculture and the people's standard of living have reached a very high level will partial conversion from crop to pasture farming and from rice to corn farming be necessary. In view, however, of the huge

population of China and the fair balance between agriculture and industry that will most likely emerge in her national economy, such situations as have arisen in England may never arise in China.

In the second place agriculture will be, together with forestry and mining, a major source of supply for raw materials for manufacturing industries. Most light industries have to acquire their raw materials from agriculture sources. A few of the more popular ones are the cotton, silk, woolen, shoe, hosiery, and rug industries. It is also obvious that the canning industry, breweries, and other food-processing industries, such as milling and meat packaging, depend largely upon agricultural raw materials. These light industries, especially those in the textile group, have played a major role in the initial stages of industrialization, as shown in the history of various industrialized countries. At the very outset of industrialization in China, the cotton textiles also have played, and undoubtedly will continue to play, a major role. It is quite probable that the silk, woolen, and food-processing industries will match the cotton textile industries within a short period of time. Of course, the great phase of industrialization will have to wait for the time when heavy industries, such as the iron and steel, the machinery and chemical industries are fully developed. It is clear that development of these heavy industries will be in the main dependent upon the exploitation of China's coal and iron ores. But it will in no degree discourage the employment of agricultural resources. On the contrary, development of heavy industries will stimulate the expansion of light industries, which, in turn, will create a larger market for agricultural raw materials. Moreover, China will undoubtedly depend in great measure on the United States, Great Britain, and Soviet Russia for the supply of heavy equipment, chemical products, and such durable goods as automobiles and trucks, and in return, to pay for them, she will most probably export "specialty goods" of which a large part will be produced in the light industries.

In the third place, farms usually supply a large amount of labor for industrial uses and the transfer of labor from farm to factory constitutes one of the most significant aspects of the

process of industrialization. This aspect is especially important for a country like China where a tremendous amount of surplus labor has existed in rural families under the form of "disguised unemployment." To what extent this surplus labor will be absorbed by industry, commerce, mining, and transport cannot be exactly predicted. But it can be stated with confidence that, as industrialization gets under way and later when it is in full swing, the shift of labor from agricultural to other industries will be a phenomenal one. There are several factors, however, about the problem that must be clearly recognized and that may serve as a guard against over-optimism. First, the shift will not be great during the early stages of industrialization. In this period, the labor now absorbed in handicrafts will get the first chance in the transfer to modern factories. This is because they are more skilled than farm laborers, and also because they have the locational advantages so far as the transfer cost is concerned. But this does not mean that some agricultural labor will not be absorbed in the early stages. During these initial stages, mining and the building of railroads and highways will urgently require a great number of workers who, undoubtedly, will be recruited largely from agricultural sources. Again, there will be a surplus of agricultural labor itself as the mechanization of farming gets under way. The situation will then depend upon the speed with which industry absorbs the surplus and the rate at which the mechanization of agriculture takes place. In view of the numerical preponderance of the rural population, which has been estimated at about 75 per cent of China's total population, it is rather doubtful whether industry can effectively absorb the whole surplus of agricultural labor existing in the initial stages of industrialization, not to mention the surplus that will occur with the introduction of farm machinery. It is to be noted, however, that the effective introduction of farm machinery presupposes an absence of a huge surplus of agricultural labor.

The final aspect of the adjustments which may possibly be made in agriculture during the process of industrialization is that agriculture provides purchasers of goods produced in industrial plants. Discussion of this aspect leads us to a con-

sideration of two points: the farmer as a consumer who buys industrial goods for consumption only; and the farmer as a producer who buys industrial goods, such as fertilizers and farm machinery, for productive purposes. To what extent the farmer as a consumer can absorb industrial goods will depend on the size of farm income and the rate of its growth. The latter will, in turn, depend on the manner in which, and the rate at which, agricultural production can be improved and increased. This leads us naturally to a discussion of the second point, the modernization and mechanization of agriculture.

There is no doubt that in the process of industrialization in China farm machinery and chemical fertilizers will be introduced into agriculture. The questions are: How great is the possibility and at what tempo will the mechanization take place? In view of China's huge rural population, which makes the introduction of machinery economically unprofitable, and also in view of the fact that the size of the farm is in general so small as to make it technically very difficult to use machinery,¹¹ the possibility of agricultural mechanization is at present really small.¹² But a fact which must be recognized is that

¹¹ According to a sampling survey made by the Chinese Land Committee in 1935, which covers twenty-two provinces of China, the average size of farm is 15.76 Mou (a Chinese measure of land; one acre is equal to 6.6 Mou) or 2.4 acres. It is to be noted that the regional differences are great, varying from the average size of 12 Mou in the Southeast to that of 145 Mou in Inner Mongolia. Distribution of the size of farm is shown in the following table.

<i>Size of Farm</i>	<i>North</i>	<i>South</i>	<i>China</i>
Under 10 Mou	27.1%	49.5%	35.8%
10-20 Mou	21.5%	31.0%	25.2%
20-30 Mou	16.8%	10.0%	14.3%
30-50 Mou	23.1%	6.1%	16.5%
50 Mou and over	11.5%	3.4%	8.3%
Total	100.0%	100.0%	100.0%

¹² In discussing the problem of the introduction of machinery in China, Tawney also takes a pessimistic yet realistic view. As he says, "China possesses a laborious and intelligent population, with unusual gifts for qualitative production; its most serious economic defect — a very grave one — is that, owing to its abundance, human labour is cheap, with the result that the introduction of machinery, which, had labour been dearer, would have taken place long ago, has been discouraged." See R. H. Tawney, *Land and Labour in China*, p. 135. This statement will apply more to agricultural production than to industrial because the degree of surplus in labor force is greater on the farm than in any other fields.

farmers, under present conditions, work overtime a great deal during the farming seasons. Both their efficiency and their well-being would increase greatly if some machines for basic farm work could be introduced. One concrete and important step would be the introduction of a pumping machine into a group of rice farms under a good irrigation system. The difficulty arising from the small size of farms can be partially overcome by undertaking a progressive program for the consolidation of farms. This can be done either through government action in buying from landlords the farms which they have no further interest in cultivating, and then redistributing them to peasants and agricultural laborers under the form of coöperative management, or through the spontaneous willingness of landlords and farmers to put their farms on a coöperative basis. In either case the government could lend a hand by establishing agricultural stations throughout the country to provide the coöperative farms with machines and other facilities necessary for basic farm work. The present war, in a way, has made the consolidation easier because in the occupied areas of China where the size of the farm is usually the smallest, the turfy boundaries of many farms have been destroyed during the war, and many landlords and farmers have either died or have left their farms. Now that the war is over, reorganization of some kind will undoubtedly be needed in regard to those farms in China's occupied areas which were devastated or obliterated during the course of the war. There is no better time than now to start a program for the consolidation of farms, which, in due course, will be extended to cover the unoccupied areas as well.

B. CAPITAL MOVEMENT FROM INDUSTRIAL TO AGRICULTURAL COUNTRIES

Industrialization, as we noted in Chapter III, may simply be called the process of "capitalization," that is, the process in which widening and deepening of capital are taking place. That process involves, of course, technological changes. Taking the world as a whole, economic development is of different degrees in different countries. There is a natural tendency for the capital to flow from the regions or countries where the marginal pro-

ductivity of capital is relatively lower to those places where it is higher, if the prospective returns are great enough to compensate for the risk of investment in addition to the transfer cost incurred.

It is well known that the cornerstone of the classical theory of international trade was assumption of perfect internal mobility and complete international immobility of the productive agents. The modern theorists have tended to accept the view that the factors of production are neither perfectly mobile within a country, nor are they completely immobile between countries: The real cases lie between these two extremes.¹³ Given a range of political and institutional obstacles which are undoubtedly much greater between countries than within a country, the theories relating to the internal and the international movements of the factors of production are essentially the same. Thus the international movement of factors is but one aspect of the "interregional" movement of them. It is in this respect that the modern theorists have tried, on the one hand, to link the international trade theory with the general interdependence theory of value, and, on the other, to link it with the general theory of the localization of economic activities.¹⁴

But the fact cannot be ignored that different factors of production have different characters, and hence their mobility not only differs one from another, but also, with some factors, the internal character differs from the international. Let us consider the three main factors of production — land, labor, and capital. Knight once said that

¹³ For theoretical discussions, see John H. Williams, "The Theory of International Trade Reconsidered," *Economic Journal*, 1929; Bertril Ohlin, *Interregional and International Trade*, Part III, "Commodity and Factor Movements and Their Relations," and Part IV, "International Trade and Factor Movements"; and Carl Iversen, *International Capital Movements* (London, 1935), Introduction and Chapter I, "The Nature of International Capital Movements," pp. 1-92.

¹⁴ The works by Ohlin and Iversen just mentioned together with Jacob Mosak's *General Equilibrium Theory in International Trade* (Cowles Commission Monograph, University of Chicago, 1904) may be taken as among the most successful attempts ever made along the line.

the peculiarity of international trade as compared with domestic lies in the immobility of population viewed as labour power. National resources are immobile even within a country, and capital goods enter into international commerce in the same way as goods ready for consumption.¹⁵

That land as a factor of production is immobile both within and between countries should arouse no argument. It is also obvious that labor may in general be considered as perfectly mobile within a country and almost immobile between countries. Question arises as to whether capital can be regarded as equally mobile within and between countries. Indeed, international capital goods sell at approximately the same price in all countries, allowing only for costs of transport, duties, and expenses in dumping. But what we mean by capital is far from being capital goods. We mean by capital "waiting" or "capital disposal." The mobility of capital refers not to the concrete capital goods, but to the productive factor for the services of which interest is the price, and that is precisely waiting or capital disposal. Thus in spite of the fact that the international mobility of capital is greater than that of labor, the relative scarcity of capital disposal is by no means equalized between countries; interest rates differ and waiting is combined with labor and land in very unequal proportions in different countries.¹⁶

As land is by nature immobile, and the movement of labor is so restricted between countries that it is practically immobile internationally, the only primary factor that can move from one country to another, though still under various forms of restrictions and impediments, is capital. Given transport cost and a certain range of artificial restrictions, capital always tends to move from economically highly developed countries to the less or under-developed, for the marginal productivity of capital is higher in the latter than in the former. This movement of

¹⁵ Frank Knight, "Some Fallacies in the Interpretation of Social Cost," *Quarterly Journal of Economics*, August 1924, p. 583.

¹⁶ A more elaborated discussion on this aspect will be found in Carl Iversen, *International Capital Movements*, pp. 27-30.

capital can be in large measure identified with the movement of capital from industrial to agricultural countries, because, with only a few exceptions, agricultural countries are in general economically less developed or are under-developed. It is obvious that capital also moves between industrial countries, or between economically highly developed countries. In this section, however, only the capital movement from industrial to agricultural countries will be discussed.

When there is political stability and a prospect of industrial development in the borrowing country, the movement of capital is subject to the general law of demand and supply, as well indicated in the interest rates prevailing in the lending and borrowing countries and other costs to be incurred in the transfer.¹⁷ This stimulates an inquiry into the causes and effects of capital movements. Some writers emphasized the causal relationship between capital movements and commodity movements. Others, among whom Harry D. White may be especially mentioned, suggest that there is a possibility that both capital exports and merchandise movements are the concomitant effects of a common cause, namely the fluctuations in business activity. White presents interesting figures about the situations in France, Great Britain, and the United States to support his hypothesis.¹⁸ In France the years 1883–1886 were years of depression and also years of comparatively low capital exports. Conversely, the revival and prosperity in 1887–1889 and more particularly in 1903–1906 were accompanied by rapidly growing export of capital. But during the remaining years there is no marked agreement. In the case of Great Britain the years 1886–1890, 1896–1900, 1904–1907, and 1909–1913 were those of high or expanding business activity accompanied by a relatively large capital export, while the depressions in 1891–1895, 1901–1903, and 1908–1909 brought also setbacks in the export of

¹⁷ It is to be noted that whereas Mill's theory, or the classical theory, merely slurs over the role of the rate of interest, the "income" or "modern" theory leaves no room for it to play a role at all. For a detailed discussion, see John Knapp, "The Theory of International Capital Movements and Its Verifications," *Review of Economic Studies*, Summer, 1943, pp. 115–121.

¹⁸ Harry D. White, *The French International Account 1880–1913* (Cambridge, Massachusetts, 1933), *passim*.

capital. But here again there are several years without correlation. In the United States the prosperity in 1923, 1926, and 1929 was accompanied by low capital exports, while the recessions in 1924, 1927, and 1930 concurred with the rising export of capital. Apparently, the correlation between the two series of figures is negative.

This cyclical hypothesis is rejected by Angell on a priori grounds. He gives two reasons for the rejection.¹⁹ First, the cyclical oscillations are in general more or less parallel in different countries. Second, even in the case of noncoincident cycles the outcome must depend on the form of the foreign investments. If the cycles are coincident and of roughly equal magnitude in different countries, they will not materially affect the international flows of capital. If they are not, discrepancies of various sorts may arise and release capital movements, but the direction of this capital movement will depend upon whether or not the investments are of a fixed-yield type.

Both White's and Angell's arguments may be taken as only partially right. Even on a priori grounds, we cannot deny that capital movements and business activity are mutually related and affected. What is doubtful is whether fluctuations in business activity can be taken as only a cause, rather than an effect, of capital movements. Moreover, in a society where economic interdependence prevails, absence of correlation tested by statistical method does not necessarily mean an absence of causal relationship. It may be due merely to the fact that other factors influencing capital movements are more powerful in some years than in others. Carl Iversen has well said that the relationship between capital export and business fluctuations must obviously depend on the nature of the lending and the borrowing country's economic life. In Denmark it has been clear that the import of capital increased in boom periods, while repayments were made during years of depression. This is a natural consequence of the dominating importance of agriculture; both the quantity and the prices of the exports of agricultural products have been relatively unaffected by the

¹⁹ James W. Angell, *The Theory of International Prices* (Cambridge, Massachusetts, 1926), pp. 527-528.

cyclical fluctuations of business, whereas the imports of iron, lumber, coal, and so on are obviously very sensitive to business activity both of quantities and prices.²⁰

From the long-run point of view, the movement of capital between different countries would reflect the characteristics, the degrees, and the stages of industrialization in different parts of the world. In the nineteenth century, England took the lead not only in the internal industrial development, but also in lending and exporting capital to other countries. France shared the dominance in a lesser degree. By that time, both the United States and Germany were among those countries which imported capital heavily.²¹ From 1850 onward the United States started to import a huge amount of capital from abroad for railway construction. Not until 1896, did she begin to buy securities from foreigners in an appreciable degree, but the net balance of capital imports was still great. In France, from 1870 to 1912, foreign investment increased from 2.3 milliards of francs to 7 milliards, but the French investment in foreign countries increased from 10 milliards of francs to 42 milliards, so the net amount of capital exports increased from 7.7 milliards to 35 milliards of francs.²² On the eve of World War I, Great Britain still held the hegemony of the world finance, while the French investment in other countries had up to then increased, but at a smaller rate. The most striking fact was that Germany began to have a large amount of foreign investment by the beginning of the present century. According to estimates²³ the foreign securities held by Germany were valued in 1914 at 5.6 billion dollars, compared with 18 billion dollars held by Great Britain and 8.7 billion by France. In the same year the same form of foreign investment was estimated at 2 billion dollars for the United States. It was obvious that in the beginning of the present century, both the United States and

²⁰ Carl Iversen, *International Capital Movements*, p. 73.

²¹ For a detailed statistical analysis of capital movements between different countries, especially between Great Britain, France, the United States, and Germany, see Jean Malpas, *Les Mouvements internationaux de capital* (Paris, 1934), pp. 19-323.

²² Malpas, p. 182.

²³ Malpas, p. 243.

Germany began to export capital appreciably. But the foreign investment of the United States has so far not held such a predominant place relative to domestic investment as in Great Britain, for the United States has a much greater domestic market than Britain to absorb newly created capital.

The long-term capital movements, which we have just presented, are historically by far the most common kind, in which both lending and trade respond to an underlying set of causes affecting them and capital movements were associated with fluctuations in world income and employment. Here the previously mentioned theories of capital transfer (relative price, or income-movements, for example) may not apply. In the nineteenth century when railway building and other construction work seemed profitable in undeveloped countries, finance was usually raised abroad for them, while at the same time imports of both investment goods and consumption goods were greatly swollen by the expenditures connected with these developments. In this case, clearly, both borrowings and increased imports were but different aspects of a complex underlying situation giving rise to them both: namely, the conditions that made railway building profitable, the need to import investment goods and other manufactures from abroad into countries not yet industrialized, and the lack of a capital market for long-term development in such places. It is important to emphasize that these underlying conditions satisfactorily and sufficiently explain the whole *modus operandi* of capital importation in such cases, and it is therefore quite redundant to search for special mechanisms of transfer which seem necessary when a sum of money needs to be remitted from one country to another and all things are assumed equal.²⁴

We are now in the postwar period of World War II. The situation is quite different today from that in the period following World War I. Great Britain, while still playing an important role, is no longer the leader in the domain of international investment. France has become a debtor country, seeking capital

²⁴ See John Knapp, "The Theory of International Capital Movements and Its Verifications," *Review of Economic Studies*, Summer, 1943, p. 119.

from abroad. Soviet Russia will still indulge herself in domestic financing and investment. The only country that can export capital in large amounts is the United States, and undoubtedly she will take the leadership in the international investment. In order to induce and maintain the postwar revival of world trade, Hansen and his followers have repeatedly advocated an "expansionist program" at home coupled with extensive foreign investments by the United States.²⁵ It is very obvious that any constructive plan of economic rehabilitation and reconstruction in the devastated or undeveloped countries must include large capital exports by the United States, if postwar economic prosperity is to be achieved.

Among countries which need capital badly both for rehabilitation and reconstruction are China and countries in Europe, and among those which need capital mainly for reconstruction are countries in Latin America. To what extent capital can be transferred from the United States to China and countries in Europe as well as in Latin America depends upon a host of factors, among which the basic and the most important are the political stability and the prospect of industrial development in the borrowing countries. Given these two factors, the economic policies adopted by the countries concerned will also have a direct and immense bearing upon the problem. To a large extent the international capital transfer in question will depend upon whether the postwar period will witness the regulation of foreign trade and finance by countries along traditional lines of protection to particular producer interests, or whether the interest of the common man as producer and consumer — employment and a high standard of living — will form the goal of international controls. In international trade and finance the orientation of policy to producers' profit margins spells protection and restriction; and the fixing of prices at levels incompatible with consumers' choices spells bilateralism, exchange control, and discrimination. The removal of these obstacles to international trade and finance effectively

²⁵ See Alvin H. Hansen and C. P. Kindleberger, "The Economic Tasks of the Post-war World," *Foreign Affairs*, April 1942.

conditions both the appearance and success of extensive foreign investment by the United States.²⁶

It is very difficult to estimate the capital-receiving capacity of some important agricultural countries during their coming phase of industrialization. For estimating the capacity, writers often use the capital requirements per worker as the calculating units. But it is difficult to estimate because capital requirements per worker differ from industry to industry both in total and in composition, and also vary according to the degree of mechanization. In discussing the problems involved in the industrialization of eastern and southeastern Europe, Rosenstein-Rodan estimated that the average amount of capital equipment per head would be £300-£350, or roughly \$1200-\$1400, based upon the figures for light industry £100-£400, medium industry £400-£800, heavy industry £800-£1500, and adding to that the capital equipment required in housing, communication, and public utilities.²⁷ He also estimated that the native capital would be 50 per cent of the total need, and that the rate of investment, that is, the ratio of total investment in a given period to the total income in a given period, would be 18 per cent, the same as that of Soviet Russia. Another research group, in giving a more detailed illustration for the case of southeastern Europe, estimated that typical light, medium, and heavy industries with a medium degree of mechanization in each group may require fixed capital about as indicated in the table on page 216.²⁸ All these estimates are, of course, subject to many qualifications. The unknown factors are so many that the estimates render no great value other than theoretical illustrations. It presents one picture of the need for capital in one group of agricultural countries during their process of industrialization.

The need for foreign capital for industrialization and the

²⁶ See Howard S. Ellis, "Removal of Restrictions on Trade and Capital," *Postwar Economic Problems*, edited by Seymour Harris (New York and London, 1943), pp. 346, 359.

²⁷ P. N. Rosenstein-Rodan, "Industrialization of Eastern and Southeastern Europe," *Economic Journal*, July-September 1943, p. 210.

²⁸ P.E.P. (Political and Economic Planning), *Economic Development in Southeastern Europe* (London: Oxford University Press, 1945), p. 57.

way foreign investments will be successfully carried out in the agricultural countries of Asia, especially in China, are topics of greatest common interest to the borrowing and the possible lending countries. Let us take the case of China for a further survey.²⁹ According to an estimate, modern industrial capital

INVESTMENT AND POWER REQUIREMENTS PER WORKER
(at prewar prices)

	<i>Land and buildings</i>	<i>Plant and equipment</i>	<i>Total fixed capital</i>	<i>H.P. installed</i>
Cotton weaving	\$300	\$ 600	\$ 900	1.5
Metal working	400	750	1150	2.5
Chemical Fertilizers	800	3500	4300	5.0

in China before the war amounted to only 3.8 billion Chinese dollars (prewar value, approximately equivalent to 1.2 billion United States dollars), which estimated on the basis of a population of 450 million gave a per capita share of less than nine Chinese dollars, or in United States money \$2.70.³⁰ This amount is obviously inadequate to serve as a basis for China's postwar industrialization, even on a moderate scale. In view of the small amount of people's saving which gives no prospect of a large native capital in the immediate future, and with a view not to further reducing the people's standard of living which is already too low, utilization of foreign capital, especially from

²⁹ For factual background and discussions more in detail, the reader is recommended to refer to C. F. Remer, *Foreign Investments in China* (New York and London, 1933); W. Y. Lin, "The Future of Foreign Investment in China," in *Problems of the Pacific* (New York, 1939); and H. D. Fong, *The Postwar Industrialization of China* (Washington, 1942), Chapter 6, "Capital and Management in China's Postwar Industrialization," pp. 54-76.

³⁰ Estimate by a Chinese economist, Tso-Fan Koh. See his article, "Capital Stock in China," in *Problems of Economic Reconstruction in China* (Mimeographed), China Council Paper No. 2, Institute of Pacific Relations, 8th Conference at Mont Tremblant, December, 1942. As quoted and commented by H. D. Fong, "it fails to include the influx of Japanese capital into Manchuria since 1931, and refers to the industrial capital in a narrow sense, covering only capital in modern industries." See H. D. Fong, *Postwar Industrialization of China*, p. 55.

the United States, the country with the greatest capital-lending capacity, is highly recommendable and will be beneficial to both countries.³¹

To what extent China needs foreign capital cannot be accurately estimated. It is certain that the speed and the degree of industrialization will to a large extent depend upon the capital available. Thus given the amount of capital obtainable in a given set of economic circumstances, the speed and the degree of industrialization, or the rate of economic development, of a country may be roughly determined. Eugene Staley, applying the comparative method by multiplying the Japanese capital investment figures³² for a given decade by the ratio between Chinese and Japanese land area, has estimated the amount of capital investment for China for the four decades in the post-war period. As he explained, the Japanese investment figures were split into two parts.³³ One part, representing investment in industry and commerce and in local public works, was as-

³¹ The relative advantage of capital lending to the capital-importing and capital-exporting country has long been a topic of controversy. The classical theorists, down from J. S. Mill, have held that the importation of capital necessarily causes a shift in the net terms of trade in favor of the borrowing country, and that such a shift is essential for the transfer of the loan in the form of goods from the lending to the borrowing country. The most complete analyses of this theory are to be found in the writings of Taussig and Viner. The modern theorists, especially those of the school of the general economic interdependence, do not agree with them. It is even questioned whether the terms of trade can be measured quantitatively. See writings by Ohlin and by Carl Iversen as quoted before, and Roland Wilson, *Capital Imports and the Terms of Trade* (Melbourne, 1931), pp. 47-81.

³² The capital investment in Japan from 1900 to 1936 was calculated as follows (in millions of United States dollars, at 1936 Japanese prices and exchange rate):

<i>Period</i>	<i>Total</i>	<i>Average per year</i>	<i>Investment as per cent of national income</i>
1900-1909	783	78	12%
1910-1919	1,658	166	17
1920-1929	3,128	313	12
1930-1939	2,476	354	10

See Eugene Staley, p. 71 *World Economic Development*.

³³ For a detailed analysis, see Appendix by Robert W. Tufts to Chapter 4, in *World Economic Development*.

sumed to be closely related to population. The other part, representing investment in undertakings connected with agriculture and transportation, was assumed to be closer to land area. The figures for the first type of investment for a given decade were multiplied by the ratio between the present population of China and the 1900 population of Japan, and the figures for the second type of investment were multiplied by the ratio between the two land areas. These results were then added to give a weighted average based both on population and area. By this method he obtained the following figures for China: first decade, 13.6 billion United States dollars (at 1936 prices); second decade, 23.1 billion dollars; third decade, 44.9 billion dollars; and fourth decade, 51.6 billion dollars.³⁴ These figures as estimated by Staley for China will undoubtedly have some value for reference, but it is also obvious that they have a very limited applicability. First, the economic conditions of China and Japan are far different from each other, and the rate of investment cannot be assumed to be the same in both countries in relation to population and to land area. Second, merely population and land area cannot fully express the potentiality of capital investment; resources, size, and distribution of national income must be brought into the picture. Finally, technology as a factor must receive consideration, and evidently the ways and the rate of economic development for Japan in the decades of 1900–1936 in no way fit the Chinese situation in the immediate decades to come. In conclusion, we may say that whatever figures of capital requirements may be obtained for China, if the amount of native capital and the rate of its accumulation is known, foreign capital acquired will play an important role in determining the extent and the rate of her industrialization. It may also be emphasized that from the experience of the United States, some European countries, and China in the past several decades, transport will be among the paramount fields first to receive and utilize foreign capital. The development of water-power should also be highly important in a country with inadequate coal resources.

³⁴ Staley, *World Economic Development*, p. 71, Table 2.

C. TRADE BETWEEN AGRICULTURAL AND
INDUSTRIAL COUNTRIESCHARACTER AND SHIFTS OF TRADE BETWEEN
AGRICULTURE AND INDUSTRY

If we abandon the assumption of the classical theory that factors of production are perfectly mobile within a country while completely immobile between countries, the nature of international trade would be essentially the same as domestic exchange. Both may be explained by a broader and more general theory based upon the interregional analysis.⁸⁵ In fact, even in prewar China, trade difficulties and obstacles were much greater between Shanghai and Kunming than between Shanghai and San Francisco or between Shanghai and Hong Kong, especially so far as transportation was concerned. This explains, to a large extent, why in the period between two wars Shanghai imported annually a huge amount of rice from Burma and Indo-China by way of Hong Kong rather than from the interior provinces. However, the differences between domestic and international trade should not be overlooked or minimized, although these differences are more of social and political than of economic character. When we talk about trade between agriculture and industry, differences between domestic and international trade become greater and more evident. This is because the economic structure of an agricultural country differs far more from that of an industrial one than does that of regions within a country.

In theoretical discussion we assume, for convenience, that agricultural countries import only manufactured goods and export only farm products, while in industrial countries the opposite is true. This is in large measure a real situation. But it should be recognized that this does not exclude the possibility

⁸⁵ One attempt along this line is Bertril Ohlin's. See his *Interregional and International Trade*. Another attempt is John D. Black's, when he wrote an essay on interregional analysis under the recognition that "the major portion of that body of analysis that is ordinarily presented as international trade theory has equal application to a considerable range of subjects that are interregional within a country." See his essay "Interregional Analysis with Particular Reference to Agriculture," in *Exploration in Economics*, pp. 200-210.

and even the fact that an agricultural country also imports agricultural products while an industrial country imports manufactured goods. For no country, agricultural or industrial, can be completely self-sufficient. Nor does it exclude the possibility and the fact that an agricultural country may even export some industrial goods while a highly industrial country may export some farm products. For no country is in reality purely agricultural or purely industrial.

The difference between the interregional trade between agriculture and industry within a country and the international trade between agricultural and industrial countries lies not so much in the goods themselves as in the socio-economic conditions setting the stage for trade. There are several types of trade between an agricultural and an industrial country according to the criterion of socio-economic conditions. One is the colonial type in which trade takes place between a highly industrial country and its colonies, which are often called "agricultural colonies."³⁶ The mother country regards its agricultural colonies merely as a supply source of raw materials and a market for the manufactured goods. To achieve this the highly industrial country acquires "concessions" from the colonies to obtain the sole right or monopoly of trade.³⁷ By this means the colony's economy is made not only complementary to that of the mother country, but actually bound to it, affording opportunities of profits on such a scale as to attract a considerable amount of capital from the mother country. The other may be called the "bilaterally symmetrical" type in which an agricultural country and an industrial country trade with each other on equal terms. Here the agricultural country may be already industrialized and her people may have attained a high level of income and

³⁶ Analysis of this and other types of colonies will be found in G. U. Papi, *The Colonial Problem: An Economic Analysis* (London, 1938), pp. 2-3.

³⁷ To this type of trade, theory of monopoly and monopolistic competition would better apply. It has been inferred from the monopolistic competition theory that under this type the volume of trade would be smaller than would otherwise be the case. See W. E. Beach, "Some Aspects of International Trade under Monopolistic Competition," in *Exploration in Economics*, pp. 102-108. Whether and how the theory of exploitation would apply to this colonial type of trade remains to be vindicated.

standard of living. Denmark and Australia may be cited as examples. The characteristics of this type of trade resemble the characteristics of the demand for and supply of agricultural products compared with that of manufactured goods.

When an agricultural country is industrializing herself, the character and constitution of her trade with other countries begin to change. In general

the experience has been that as countries develop and modernize their production they import more of all the major categories of commodities. They import more foodstuffs, more raw materials, more semi-manufactured and more finished goods, but, as might be expected, imports of raw materials and partly finished goods increase in "relative" importance. On the export side, experience shows that a country moving from a less developed to a more advanced stage of economic development begins to sell more finished and partly finished goods abroad. It is likely, however, also to increase its exports of crude materials and foodstuffs, though these may decrease in "relative" importance.³⁸

Thus it is not well founded to suppose that industrialization, which increases the ability of a country to carry on modern production processes, must ordinarily lead to a decrease in its imports of manufactured goods. By and large, just the opposite has been true in the past.

This may be well illustrated by the experience of Japan. During the period of industrialization Japan usually had an excess of imports which consisted largely of raw materials, such as raw cotton, and metals, and machinery. From 1912 to 1923, her imports increased by three times, from 618,992,000 yen in 1912 to 1,987,063,000 yen in 1923. Changes in the composition of imports are shown by percentage distribution in Table 27. It is clear that except in the war period, from 1915 to 1918, the percentage distribution of imports of Japan was almost constant. The major part covered raw materials and unfinished goods, indicating the situation common to a country in her early stages of industrialization.

On the other hand, Japanese exports also increased almost

³⁸ Eugene Staley, *World Economic Development*, p. 135.

TABLE 27
PERCENTAGE OF IMPORTS OF JAPAN*†

Periods	Food and drink	Raw materials and unfinished goods	Wholly finished goods
1912-14.....	13.7	68.5	17.1
1915-18.....	6.3	82.5	10.3
1919-22.....	13.6	69.5	16.2
1923.....	12.6	67.7	17.7

* From S. Uyehara, *Industry and Trade of Japan* (London, 1926), p. 65.

† Percentage of the total value of imports.

three times during the same period, from 526,982,000 yen in 1912 to 1,447,749,000 yen in 1923. From the same source, changes in the composition of exports are again shown by the percentage distribution. In looking over Table 28 we notice

TABLE 28
PERCENTAGE OF EXPORTS OF JAPAN*†

Periods	Food and drink	Raw materials and unfinished goods	Raw silk	Wholly finished articles
1912-14	10.3	30.8	28.6	29.1
1915-18	10.5	28.2	21.6	37.1
1919-22	6.8	18.4	30.9	42.4
1923	6.3	14.8	39.2	37.4

* From S. Uyehara, *Industry and Trade of Japan*, p. 59.

† Percentage of the total value of exports.

the remarkable change of character of Japan's export trade which has taken place during her important stages of industrialization. Decrease in the export of food and drink is a phenomenon common to most industrializing countries and shows that the increase of population and the rise of income have created a great demand for home-produced foodstuffs and have checked

their exportation. Raw materials and unfinished articles were exported by gradually decreasing percentages because they were more needed by home industries in the latter's expanding process. The only item which showed an increase in exports was raw silk whose supply was under Oriental monopoly and demand for which was increased abroad during the period. Most noticeable was the increase in export of the wholly finished articles. This would, of course, have some effects on the exports of other highly industrialized countries.

The experience of Great Britain is, however, slightly different. The exports of crude materials and foodstuffs decreased not only relatively, but also absolutely. This is because Britain is a country which took the initiative in industrial revolution, and whose agricultural resources have never been sufficient to meet even her own demand. In the earliest periods of her trade, wool and tin were the chief exports, and then manufactured woollen cloths came into prominence. Similarly in more modern times, owing to the Industrial Revolution and the introduction of machinery and steam power, her greatest exports have been in textile goods and in manufactures of metals.³⁹ Among the imports, foodstuffs and raw materials, especially cotton, wool, and metals, are the most important items. Imports of manufactured goods have never been significant.

TERMS OF TRADE BETWEEN AN AGRICULTURAL AND AN INDUSTRIAL COUNTRY

The concept of "the terms of trade" and their determination have long constituted an important portion of the discussions of the classical and neoclassical economists.⁴⁰ Taussig first speaks of "the barter terms of trade," and later uses the meas-

³⁹ For discussion of British commerce during the later periods of the Industrial Revolution, see H. de B. Gibbins, *British Commerce and Colonies* (London, 1897), pp. 113-116.

⁴⁰ For a review of theories concerning the terms of trade, see Gottfried Haberler, *The Theory of International Trade* (New York, 1937), pp. 159-166. A statistical analysis of the terms of trade is to be found in Colin Clark, *Conditions of Economic Progress*, Chapter 14, "The Terms of Exchange." As to qualifications in general of this analysis, see Simon Kuznets, "Economic Progress," a review on Clark's book in *Manchester School*, April 1941, pp. 28-34.

ure which is the ratio between export prices and import prices.⁴¹ In Marshall's sense, the exchange ratio between his specially defined G-bales and E-bales is measured in terms of labor.⁴² Thus the real terms of trade between an agricultural and an industrial country may be measured by either (a) the ratio between the quantity of wheat (agricultural product) and the quantity of linen (manufactured goods) exchanged — the *barter* terms of trade; or (b) the ratio between the money prices (per unit) of the two goods — the *commodity* terms of trade; or (c) the ratio of money wages spent in producing the two commodities — the *labor* terms of trade. But here a fundamental question may be asked: Can these various measures of the terms of trade really indicate the satisfaction of two groups of consumers trading with each other, and hence the relative advantages of two countries to which they belong? This question will lead to the controversy on the interpersonal comparison of utility to which no satisfactory answer can be given at the present stage of economic study.⁴³ By keeping this in mind, we shall realize the limitations of the measures under the present inquiry.

Following the neoclassical doctrines, it may be stated that the relative advantage of the terms of trade between an agricultural and an industrial country depends, first, on the products under exchange. An agricultural country would be under relatively less favorable conditions because the demand for her products abroad is in general less elastic. As Taussig has said,

the degree to which the barter terms of trade, both net and gross, are altered to the disadvantage of the United States (or to the advantage of Germany) depends on the conditions of demand. The particular figures just chosen to illustrate the consequences of a tribute payment

⁴¹ See F. W. Taussig, *International Trade* (New York, 1927), p. 8. In the Appendix Taussig gives computations of prices and the terms of trade for Great Britain, Canada, and the United States; see pp. 411-419.

⁴² For detailed discussions, see Alfred Marshall, *Money, Credit, and Commerce* (London, 1929), Book 3, Chapters 7 and 8, and especially Appendix J.

⁴³ As to problems involved in the interpersonal comparison of utility, see a short discussion by N. Kaldor in his article "Welfare Propositions of Economics and Interpersonal Comparison of Utility," *Economic Journal*, September 1939.

were such as would result from a play of demand unfavorable to the United States. They are conditions of inelastic demand in Germany for wheat and of elastic demand for linen in the United States; in more precise terms, conditions in which the elasticity of demand is less than unity in Germany and more than unity in the United States.⁴⁴

He then postulates what he evidently believes to be the converse of this case:

If the German conditions of demand were the opposite from these — elastic for wheat — there would be a mitigation of the American loss in the barter terms. The United States would still find that she exchanged wheat for linen on terms less favorable than before, but not so much less favorable as in these illustrative figures.⁴⁵

The elasticity of demand for the commodities in trade is undoubtedly one of the important factors determining the favorableness of the terms of trade, assuming the latter is theoretically comparable and practically measurable. But there are several points of comment on the classical doctrine which centers on the conditions of demand. First, the income effect is neglected. As industrialization gets under way, people's income will rise to higher levels. Products which have a greater elasticity of demand will have greater gains in an expansionist economy. Thus manufactured goods in general have an advantage over agricultural products. Secondly, elasticity of supply and elasticity of production adjustments should also be taken into consideration. The greater the elasticity in home production, the more the gains in export abroad.⁴⁶ Also the manufactured goods are generally in a more favorable condition. This situation of relative advantage will prevail not only in an expansionist econ-

⁴⁴ F. W. Taussig, *International Trade*, p. 114.

⁴⁵ Taussig, p. 115.

⁴⁶ Richard Schüller particularly emphasizes the elasticity of production, and applies it as a criterion to determining the trade and tariff policy. His earlier arguments will be found in "Effects of Imports upon Domestic Production," in *Selected Reading in International Trade and Tariff Problems*, edited by F. W. Taussig (New York and London, 1921), pp. 371-391.

omy, but also during depression. Thus in a changing economy, which is almost entirely neglected in the classical writings, agricultural products are always in a less advantageous position than manufactured goods.⁴⁷ Finally, most of the classical teachings assume an economy of full employment and assume no technical improvements. But it should be pointed out that the terms of trade may be subject to change owing to the introduction of technical improvements which reduce the costs of the export goods of one country relative to another. Neglect of this aspect makes the classical doctrines inapplicable to the economic society where cyclical fluctuations and long-run changes occur.

EFFECTS OF THE INDUSTRIALIZATION OF AN AGRICULTURAL COUNTRY ON ESTABLISHED INDUSTRIAL COUNTRIES

It has long been a subject of controversy whether industrialization in an agricultural country will result in benefiting or doing harm to the countries which have already been highly industrialized. The old-time economists often emphasized the harmful side of the effects. Their arguments were simply based upon the possibility that an agricultural country, when industrialized, would reduce its imports of manufactured goods from abroad and would soon become a competitor of the established industrial countries in exporting manufactured goods to those countries which remained agricultural. In an economy where the income effects and technological changes are neglected and full employment is assumed, the above effects would perhaps be the most probable and the only results. But modern writers tend to recognize that this statement is oversimplified and does not always stand in a real economic society. They tend to take the view that the industrialization of an agricultural country, while being detrimental to individual industries in the old industrial countries and forcing them to make painful adjustments, de-

⁴⁷ Based on the factual investigations made by other writers, Bertril Ohlin concludes that "Europe as a whole, which exports chiefly manufactures and imports food and raw materials, is gaining from the low prices of the latter commodities." See his *Interregional and International Trade*, p. 538.

velops some compensating effects which will be beneficial to the economic society as a whole.⁴⁸

From the long-run or historical point of view, and taking into consideration the fact of the general economic interdependence, industrialization in an agricultural country is but one phase of economic development realized in one locality. Any economic change would induce some adjustments which may be painful and give some harmful results. The latter may be considered as the necessary price paid for economic progress. The adjustments may be internal or external to a country under industrialization. When they are external, as much as is the case when they are internal, the effects cannot be simply stated as being harmful or beneficial: They depend upon the individual industries as well as the point of view, whether short or long run. T. E. Gregory, in his comment on the problems of Eastern industrialization and its effects on the West, says:

In reality the problems of the relationships between East and West, which our preoccupation with our own future inclines us to regard as the most important aspect of the process of Eastern industrialization, are peripheral: peripheral not only in the sense that they are not necessarily permanent in character, whereas the phenomena which cause them are permanent. [Thus] to state the whole matter in terms of value, we must not judge the "Industrial Revolution" in the East merely in terms of the embarrassments which it may occasion to Western interests and Western industries.⁴⁹

Experience has shown that, especially in the short run, industrialization in an agricultural country does not prove beneficial to the old industrial countries if their lines of production are similar. This may be illustrated by the fact that Japan had taken the place of Great Britain in exporting cotton textiles into the British colonies in the prewar periods, as is shown in Table 29.

⁴⁸ For literature, especially in German, on this problem, see Wilhelm Röpke, *International Economic Disintegration* (New York, 1942), p. 182.

⁴⁹ See conclusions by T. E. Gregory in G. E. Hubbard, *Eastern Industrialization and Its Effect on the West* (Oxford University Press, 1935), pp. 363-364.

But it should be remembered that Great Britain's loss in textiles may have been compensated for by gains in other lines. Experience has also shown that a newly industrialized country does not decrease its imports of manufactured goods, but rather increases them, especially its imports of machinery and partly finished articles.⁵⁰ Moreover, the study of statistics proves, although it may appear paradoxical, that the greatest importers of industrial products are also industrial countries.⁵¹

TABLE 29

IMPORTS OF BRITISH AND JAPANESE COTTON TEXTILES INTO THE
BRITISH COLONIAL EMPIRE*
(unit: million yards)

Year	—To East Africa—		—To Malaya—		—To Ceylon—	
	U. K.	Japan	U. K.	Japan	U. K.	Japan
1929	23.6	32.6	86.0	34.7	27.5	8.2
1931	13.0	50.5	21.6	49.8	16.0	23.7
1933	11.7	78.2	25.9	99.5	9.6	41.4

* Gregory and Hubbard, *Eastern Industrialization and Its Effect on the West*, p. 31. Figures have been changed from monthly to annual basis.

There are several important factors which have to be taken into consideration in order to comprehend the industrialization of an agricultural country in relation to other countries. The first factor is the economic structure of the country under industrialization. In discussing the prospects for international trade, Brown classified countries which are to be industrialized into two types.⁵² One includes the poorer peasant countries, such as India, China, the countries of Eastern Europe, and Japan as it was fifty years ago. These countries will have to import most of their plant and equipment for a long time to come. It is likely,

⁵⁰ For a factual analysis, see Eugene Staley, *World Economic Development*, pp. 135-145.

⁵¹ M. Manolescu, *L'Equilibre economique Européen* (Bucharest, 1931), p. 15.

⁵² For a detailed discussion, see A. J. Brown, *Industrialization and Trade* (London, 1943), pp. 54-58.

therefore, that industrialization in these countries will lead to a considerable increase in their total demand for imports. The other type may be represented by the British overseas dominions which have a per capita income as high as most of the highly industrialized countries. Industrialization of these countries will not, in itself, bring about any considerable expansion of their international trade and may, indeed, tend to bring about a contraction. But this does not necessarily mean that the absolute volume of their international trade will decline.

Another factor is the type or method by which the country is being industrialized. In Chapter III industrialization was classified as *evolutionary* and *revolutionary*. The evolutionary type has served to increase the volume of foreign trade. In the revolutionary type, as exemplified by Soviet Russia, the industrialization, after the initial phase characterized by an enormous increase of the imports of capital goods, finally resulted in a decreasing importance of foreign trade. Whether such a rapid approach to autarchy is possible in a newly industrialized country depends, of course, in the last analysis also on the specific economic structure of the country, which in the case of Russia makes such a development exceptionally easy.⁵³ But the industrialization of the revolutionary type will not necessarily result in a decrease of foreign trade. It depends on the financing and trade policy which the country in question has adopted.

Moreover, different stages of industrialization will create effects of different character. A country undergoing the process of industrialization may in the initial stage increase its imports, while in the later stages decrease them. But at a still later stage, it may again increase its imports along with the increase in its exports. Experience has shown that between highly industrialized countries, trade even takes place in the same commodity though of different quality. For example, in prewar years,

Germany exported watches and clocks of inferior quality and imported the same of higher quality, whereas the United Kingdom exported watches of high quality and imported watches of low quality. Germany exported electrical machinery of a superior quality and im-

⁵³ Wilhelm Röpke, *International Economic Disintegration*, p. 186.

ported the same of an inferior quality, and the United Kingdom exported electrical machinery of an inferior quality and imported the same of superior quality.⁵⁴

Finally, the ability of the old industrial countries to adjust to changed conditions is also to be considered, and several writers have especially emphasized this factor.⁵⁵ Whether an old industrial country can benefit from the industrialization of agricultural countries depends in a great degree upon the ability and the ease with which she adjusts her production structure to the new situation. Hubbard, endorsing Barnard Ellinger's opinion, concludes that in the past Japan's greater concentration upon low-quality cotton made from cheap raw material has been no small part of the cause of her success in winning British markets.⁵⁶ In other words, the loss by Great Britain of the cotton-textile market in the Far East may be partially attributed to the difficulties or her inability to adjust the textile production to meet the changing demand. Of course, it may also be due to the fact that Britain found it more promising to make adjustments in other fields of production than in the textile industry.

In short, it may be concluded that industrialization in an agricultural country will lead to a new line of international division of labor. The nature and the degree of this division will again be determined by the technological changes and the resources available.

⁵⁴ H. Frankel, "Industrialization of Agricultural Countries and the Possibilities of a New International Division of Labour," *Economic Journal*, June-September 1943, p. 195.

⁵⁵ See H. Frankel, *ibid.*; and A. G. B. Fisher, "Some Essential Factors in the Evolution of International Trade," *Manchester School*, October 1943.

⁵⁶ G. E. Hubbard, *Eastern Industrialization and Its Effect on the West*, pp. 79-80.

CONCLUSION

THE INTRODUCTION to this book presented four main problems for analysis. Now, in the light of the foregoing chapters, I shall attempt to answer these major questions: 1. Is industrial development a necessary or a sufficient condition for agricultural reform in a densely populated rural region, or vice versa? 2. Is it possible to maintain a balance between agriculture and industry within a given country? 3. Is it possible to maintain harmonies and mutually beneficial relations between countries primarily agricultural and those essentially industrial, and if, in an agricultural country, the process of industrialization sets in, what are the possible effects of this on the countries already highly industrialized? 4. What are the problems which would most probably confront an agricultural country like China during its process of industrialization?

1. As to the first of these problems, it may be concluded that industrial development is a necessary, but not a sufficient, condition for agricultural reform and improvement, if by agricultural reform and improvement we mean mechanization in agriculture and the large-scale organization of farm enterprises. Industrial development is a necessary condition because farm machinery, chemical fertilizers, and other equipment and instruments necessary for modern farming have to be supplied by modern industry. Moreover, only an appreciable rise of people's income which is to be secured from industrial and commercial expansion can raise, though at a decreasing rate, the demand for farm products and stimulate the improvements in agriculture. But industrial development alone cannot sufficiently induce agricultural reform. Other conditions have to be provided simultaneously or even in advance if agricultural reform and improvement are to be effectively carried out. Among the other conditions the most important are improvements in transport, consolidation of farms, and legal regulations relating to the

redistribution of land which will make the large-scale farm organization a reality.

Historically it has been shown that among the highly industrialized countries, those which have a higher degree of mechanization in agriculture are also those which have a greater size of farm. Of this group we may mention the United States, Australia, Great Britain, and Soviet Russia. In these countries, industrial development has contributed greatly to agricultural modernization. But other necessary conditions for large-scale and scientific farming should also be recognized. Australia and the United States are new countries in which the institutional obstacles to large-scale farming are much smaller than those in old countries. In Great Britain the system of primogeniture has been among the chief factors keeping the farm holdings from further division. The enclosure movement, twice seen in her history, was as significant as commercial and industrial expansion in stimulating and facilitating the agricultural reform and improvement. Soviet Russia has removed all the institutional obstacles to farm reorganization by revolution and thus paved the way for the establishment of state and collective farms. On the other hand, there are several industrialized countries whose agriculture is not highly mechanized partially because of the institutional restrictions standing in the way of farm consolidation and land redistribution. Of this group Japan, Germany, France, and Belgium may be mentioned. Their agricultural improvements have been confined largely to application of chemical fertilizers and adoption of crop rotation and other new farming methods rather than introduction of farm machinery. The high density of population in these countries is also among the serious obstacles. The same explanation may apply to Denmark, though her industrial production is far less important than agricultural.

2. Answers to the second question, that is, whether in a given country it is possible to maintain a balance between agriculture and industry, depend, first of all, on the concept given to the term "balance." It may be stated in general that in an evolutionary process like industrialization, this question really occupies no place because there is no such thing as balance if used in

its genuine sense. Theoretically, we should admit that given a state of technology there should be an optimum point of adjustment between agriculture and industry. This optimum point may be called "balance" or "point approaching balance." Thus in our evolutionary process, there will be, also theoretically, a series of such points which construct an irregular curve of adjustments between agriculture and industry. However, in reality such optimum points may never be reached. Thus no balance or curve of balance between agriculture and industry can be really attained. Moreover, comparing the two production fields under inquiry, we may say that, while the expansion of agriculture is somehow limited, the expansion of industry is almost indefinite. In an expansionist economy, if given the rate of population growth and the possible change in the size and distribution of income, increase and shifts in the demand for food can, to a large extent, be ascertained. This means that the function of agriculture in supplying food is estimable even in a changing economy. But its function of supplying raw materials cannot be definitely predicted, and it depends in great measure upon the expansion of industry and the development of synthetic products as substitutes. On the whole, the expansion of agriculture can be more or less estimated because supply of food constitutes overwhelmingly its major function. The case is entirely different with industry. There the creation of new products and their expansion are so varied and uncertain as to be in no way predictable. Therefore, in a real changing world, it is impossible to conceive any balance between agriculture and industry, when one of them is almost completely unknown.

But the balance between agriculture and industry may be expressed in terms other than the functions performed. It may be measured in terms of national product or national income, or in terms of working population. Neither method is satisfactory, owing to the defects inherent in the quantitative analysis which in no way can express adequately the qualitative changes. Nevertheless, they are the only measures available at the present stage. For this reason, we have employed them in Chapters II and IV to indicate the change of the place of agriculture in relation to industry. The concept of balance in terms of work-

ing population has long been emphasized because after all economics is a human science, dealing with the material well-being of mankind.¹ No matter what measure is employed, it has been shown that the relative importance of agriculture in the whole economy has been on the decrease in an expansion process of economic evolution. It is in the main due to the relatively lower income-elasticity of demand for farm products. This, however, does not mean that agriculture itself has been declining in the absolute sense. On the contrary, agricultural production has been expanding rapidly since industrialization was first introduced, taking in view the world economy as a whole. Only the *rate* of expansion is smaller in agriculture than in industry. Thus even in a highly industrialized country the absolute number of working population engaged in agriculture and the absolute amount of agricultural production may not decrease at all.²

3. The question as to whether it is possible to maintain harmonious and mutually beneficial relations between countries primarily agricultural and those predominantly industrial may be answered from an examination of the following two aspects. In the first place, barring the political consideration, the interdependence between the economic activities performed by an agricultural country and those by an industrial country is no less close and profound than the interdependence of economic activities between agriculture and industry within a country. Here there are two points to be considered. On the one hand, the differences in physical factors as indicated by climate and resources and differences in cultural background as revealed in

¹ Recently there is an article dealing with the "Rural-Urban Balance" in terms of working population. See Arthur P. Chew, "Postwar Planning and the Rural-Urban Balance," *Journal of Farm Economics*, August 1945, pp. 664-675.

² The only exception is Great Britain, where an absolute decline of agriculture has taken place. But if we include the economic activities of her dominions and colonies and consider the British empire as one country, our statement would still stand.

In the United States, the total number of farm laborers has decreased since the 1920's, but agricultural production has been continuously on the increase. See John M. Brewster, "Farm Technological Advance and Total Population Growth," *Journal of Farm Economics*, August 1945, p. 513, Table 1. Difference between these two measures was due to the great advances in, and a wide application of, modern farm technique in recent decades.

labor skill are greater between countries than within them. Thus the division in production on the international level seems to have a greater range and a higher degree than on the national scale. On the other hand, the necessity of international division of labor is partially offset by the attempt of attaining self-sufficiency as revealed in national economic policies. This attempt was chiefly responsible for the parallel movement in recent decades, that is, the "agrarianization" of industrial countries and the "industrialization" of agricultural countries, the first being especially reactionary and contrary to the trend of economic evolution. These two factors, physical and political, tend always to work in the opposite direction.

In the second place, if we approach the problem from a long-run point of view and use the concept of industrialization as given in this analysis, then industrialization in agricultural countries would have to be viewed as the inevitable result of economic development. The effects will in the long run prove beneficial both to the industrializing countries and to those already highly industrialized. It will be so because it will raise the productivity and the income level of the countries newly under industrialization, and, in turn, raise their marginal propensity to import which will profit the old industrial countries. But, for these benefits, some price must be paid. Industrialization in an agricultural country will undoubtedly have competitive effects on some industries in the old countries. The new industrial country may first reduce some of her imports from the old ones, and later compete with them in a third market. It will compel the old industrial countries to make adjustments in production in one way or another in order to meet the changed situation. To what extent the old industrial countries will benefit from the industrialization of an agricultural country depends in great measure upon its ability to make the adjustments. The adverse effects of this kind and their impact on the adjustments are essentially not very different from those necessarily resulting in the internal economic structure of the agricultural country newly under industrialization.

4. In Chapter VI, I attempted to describe and appraise the possible implications and complications raised by the industrial-

ization of an agricultural country. We may be now in a better position to understand the problems of China's industrialization. The purposes and the scope of this essay do not permit any detailed inquiry into the problem, and in Chapter VI only a brief analysis has been made of the role that agriculture will play and the possible adjustments to be made in agriculture during the process of industrialization.

Several points pertaining to the case of China may be stated as conclusions. First, it may be said that stimulus for industrialization must be found in sources other than agriculture. This means that agriculture will play only a passive role in the coming process of economic transformation. Second, it has been made evident that industrial development is a necessary, though not a sufficient, condition for agricultural reform and improvement. This is due, in the main, to the characteristics of the production structure of the two fields. The change of the strategical production functions is made possible only when industrial development gets under way. These two may, to a large extent, be identified. The assertion that agriculture may alone develop without relying on industry does not recognize this strategical point. Third, consolidation of farms which presupposes a drastic policy of land reform and improvement is considered most important in addition to the stimulus and support to be received from industrial development. Finally, industrialization of China will undoubtedly have some competitive effects on the old industrial countries in some production lines, but these effects will not be felt for a long period to come. Moreover, they will be partially offset by the increase of the purchasing power of the Chinese people. And if the old industrial countries make efforts to adjust their production accordingly and simultaneously, the industrialization of China and other agricultural countries will lead to a new line of international division of labor which will in the long run prove beneficial both to the agricultural and to the industrial countries.

APPENDIX A

THE CONCEPT OF AN "INDUSTRY"

No QUESTION arises when in daily usage we speak of the paper industry, the textile industry, or the iron and steel industry, and under the textiles, of the woollen, cotton, or silk industry. But as soon as we pass from the practical to the theoretical domain, difficulties in clearly defining an "industry" arise and appear to be almost insurmountable. Robinson has defined an industry as "a group of firms producing the same commodity for the same market."¹ But he then points out that in real life different producers seldom produce "the same goods." Thus when we speak of the iron and steel industry or the cotton industry, we are referring not to a group of firms producing what we may regard as a single commodity, but to many firms producing all sorts of different textile or steel products, an individual firm often producing several articles inside a single plant. From this we see clearly that the crucial point of the difficulty lies in the absence of a "homogeneous, identical commodity" in the practical world, which, in the last analysis, is the prerequisite to the formation of a theoretical concept of an industry.

The classical theorists, while basing their analysis upon the assumption of pure competition, used industry to refer to the number of sellers who are supposed to compete for the sale of a "homogeneous, identical commodity." So long as the assumption of pure competition holds, and the homogeneity of a commodity is not to be questioned, this concept of industry is perfectly legitimate and acceptable. But once the question of homogeneity or identity, which the classical theorists did not make clear, is raised, the original vagueness and ambiguity of the concept is immediately evident. More serious than this, the

¹ E. A. G. Robinson, *The Structure of Competitive Industry* (New York and London, 1932), p. 7.

whole classical theory of competition between industries, which has been built mainly upon this vague concept, is also shaken. The foundation is obviously too weak for the heavy superstructure. Unless we can broaden the definition of industry in such a way as to make it a suitable foundation to carry the heavy burden laid upon it, the logical consistency of the classical theory of pure competition will be vitally damaged.

Both the theorists of monopolistic competition and the theorists applying the general equilibrium approach have made great efforts to overcome such difficulties.² The former group, of which Joan Robinson and Chamberlin are the representatives, took an easy way out by adding the analysis of the firm without foregoing the analysis of the industry. The concept of an industry is still to be narrowed down to the concept of a commodity of product. Mrs. Robinson for convenience prefers to use a rough-and-ready definition of a single commodity which is congenial to common sense and causes no trouble.³ Her concept of industry implies the assumption that the products of different firms consist of a "chain of substitutes" surrounded on each side by a "*marked gap*" within which the demand for the product of each firm is equally sensitive to the price of any of the others. The "boundary" is thus defined as the limit beyond which this sensitiveness ceases or at any rate becomes a different order of magnitude.⁴ Kaldor uses the concept of a "scale." Each "product" can be conceived as occupying a certain position on a scale; the scale being so constructed that the products which neighbor each other are those between which the "consumers' elasticity of substitution" is the greatest. (A product itself can be defined as a collection of objects between which the elasticity of substitution of all relevant consumers

² Triffin has discussed the concept of a group or industry in a very comprehensive section of his book, and further reference to that section is recommended. See Robert Triffin, *Monopolistic Competition and General Equilibrium*, Chapter 2, Section 3, pp. 78-89.

³ Mrs. Robinson defines commodity as "a consumable good, arbitrarily demarcated from other kinds of goods, but which may be regarded for practical purposes as homogeneous within itself." See Joan Robinson, *Economics of Imperfect Competition*, p. 17.

⁴ Joan Robinson, p. 5, and N. Kaldor, "Mrs. Robinson's 'Economics of Imperfect Competition,'" *Economica*, 1945, pp. 339-340.

is infinite.) Chamberlin employs the concept of a "group," which may be large or small, depending upon the degree of generality given to the classification.⁵ The group need not necessarily be defined on the basis of the "substitutability" between the products. "It seems much easier and more defensible to set up classification (of industries) based upon 'technological criteria' than upon the possibility of market substitution."⁶

It is evident that the modifications brought about by monopolistic competition have not satisfactorily solved the difficulties mentioned in the beginning of this section. The situation still remains the same: Only in the case of pure competition does the grouping of firms into one industry reduce to a more simple and more definite type the behavior and reactions of the sellers. Outside of that simple case, grouping of firms does not in the least reduce the complexity and variety of competitive patterns. Mainly for this reason, some theorists in the camp of general equilibrium approach assert that, in the general pure theory of value, the group and the industry are useless concepts. The new wine of monopolistic competition should not be poured into the old goatskins of particular equilibrium methodology. When the study of competition is freed from the narrowing assumptions of pure competition, only two terms remain essential for the analysis: The individual firms, on the one hand; the whole collectivity of competitors on the other. It is from these materials that a general theory of economic interdependence can be built most simply and conveniently.⁷

It has been made clear that, because of the existence of imperfect competition and product differentiation, the concept of "industry" is not only untenable, but also useless. The question that now confronts us is: Can, and in what way should, we compromise the logical consistency in theory with the realistic soundness in the economic world? An illustration may help make this point clear. Many pure theorists have loosely used some hypotheses or assumptions — for instance, maximization

⁵ E. Chamberlin, *Theory of Monopolistic Competition*, pp. 100–104.

⁶ E. Chamberlin, "Monopolistic or Imperfect Competition?" *Quarterly Journal of Economics*, vol. LI, no. 4 (1937), p. 568, footnote.

⁷ Robert Triffin, *Monopolistic Competition and General Equilibrium*, p. 89.

of profit and maximization of satisfaction — to carry on their analysis and build up theoretical models. On the other hand, criticism has been made by some “realistic” theorists on the basis that the generalizations at which the pure theorists have arrived are too remote from reality to have any application values.⁸ This is a question so important, as well as so controversial, that it can be treated no further in the scope of the present essay. What needs to be said here is that the same implications as illustrated apply to the problem that we have been discussing above. The concept of industry may not be tenable and useful in the general pure theory of value, but its value for empirical study is not to be denied. Therefore, we are turning to the realistic side of the problem. It should be pointed out, however, that this does not mean that we are retreating from the theoretical front. It has always been the present writer’s belief that coming together or coming into entire agreement of theories and “realistics” is a common objective, to whose attainment the endeavors of both the pure theorists and the practical analysts should be unstintedly devoted.

On the realistic side, the concept of industry is not only made possible, but also made necessary. If we allow “a certain *range* in the neighborhood of any two industries” which range is due to a gap or an overlapping space in the classification, it would be quite legitimate to define an industry and thus classify industries according to the definition. An industry may be defined as a group of firms producing a similar group of commodities. The lines of division between different industries are to be drawn, as discussed above, according to either market substitutability or technological criteria. It should be further pointed out that this division should be based on the “unsophisticated facts of the market,”⁹ and, furthermore, should be made according to the purposes of our analysis.¹⁰ The concept of industry is made necessary not only because the Classical as well as the Neoclas-

⁸ See E. F. M. Durbin, “Method of Research — A Plea for Co-operation in the Social Sciences,” *Economic Journal*, June 1938; L. M. Fraser, “Economists and Their Critics,” *Economic Journal*, June 1938; Theo Suranyi-Unger, “Facts and Ends in Economics,” *Economic Journal*, March 1939.

⁹ Knight, *Risk, Uncertainty and Profit*, p. 125.

¹⁰ Marshall, *Principles of Economics*, p. 100, footnote 1.

sical theories are based on the equilibrium of industry, but also because any empirical study and especially any analysis of economic policy is bound to use the concept of an industry and presuppose a possible classification of industries.¹¹

¹¹ Leontief, in an empirical application of general equilibrium analysis to the structure of American economy, replaced the rigid theoretical concept of an industry by a realistic one, and upon that concept made a classification of industries on some justifiable grounds. See his *Structure of American Economy*, 1919-1929, pp. 20-21.

APPENDIX B

AGRICULTURE AS AN INDUSTRY

IN THE BROAD SENSE, agriculture is only one of many industries. If we stick to the theoretical definition that an industry includes a group of firms or producers producing the same commodity, obviously we can divide agriculture into several industries, such as the wheat-growing industry, the fruit-growing industry, the dairy industry, and so on. We can even further divide, for example, the fruit-growing industry into several according to what kind of fruits farmers are growing. This would lead us again to an endless chain of classification which would make practical analysis impossible or very difficult to undertake. Therefore, we must resort to some practical considerations even at the expense of logical consistency and theoretical purity. The reconciliatory method as mentioned above, that is, the method of allowing a certain range of errors for classification, is again to be adopted. In this sense, agriculture would be treated as one industry, or simply called the "agricultural industry."¹² It "grows"¹³ a group of products which have market substitutability of almost the same degree, for actually, most food products can be substituted for each other and hence have a high market substitutability; and elasticity of demand of the same magnitude, since the price elasticity of demand for most farm products and the income elasticity of demand for most food products are both relatively low. Moreover, agricultural production is undertaken under the most similar technical con-

¹² For a book which devotes one chapter to describing the agricultural industry, to differentiate it from fishing, mining, manufacturing and other industries, see J. G. Glover and W. B. Cornell, *The Development of American Industries*, Chapter 2, "The Agricultural Industry," pp. 15-38.

¹³ Black treats agriculture as one of the genetic industries, and defines the latter as those industries which "grow" their product. See John D. Black, *Introduction to Production Economics*, p. 70.

ditions, one of which is, for example, that the elasticity of production adjustment¹⁴ is very small.

As Black has emphasized, agriculture, in comparison with other industries, is a field of production "genetic" in nature and primary in the production stage and has therefore classified all industries in the three groups,¹⁵ extractive, including mining, lumbering, fishing, hunting, and water-power utilization; the genetic industries, including agriculture, forestry, and fish culture; and the manufacturing and mechanical industries, including factory works, construction, and hand trades. Fisher of Australia, however, has divided economic development into three stages: the primary producing (agricultural and pastoral) stage, the secondary or manufacturing stage, and the trade and transport or "tertiary" stage.¹⁶ This division brings both historical significance and technological considerations into the picture. The point we want to emphasize here is that agriculture is a primary industry. Black and Fisher both thus designate it.

This essay emphasizes most the industries which have direct relations with agriculture, such as the textile industry and the farm machinery industry. Through these industries, others having indirect relations with agriculture are also brought into the picture. Furthermore, transportation, which as a field of production is to be distinguished both from agriculture and from industry in the narrow sense, of manufacturing and mechanical trades, comes in for its due share of the discussion. It should be recognized, however, that historically industry even in the narrow sense is not confined to modern manufacturing and mechanical production, but includes as well the handicrafts or hand-trades which prevailed before the modern factory system was first established. It is in this respect that the concept of industry as employed in the present essay is to be slightly broadened.

The conceptions adopted in the present essay both for agri-

¹⁴ The elasticity of production adjustment is somewhat like, but not the same as, the elasticity of substitution in production, and, besides changes in the combination of production factors, it includes also changes in the scale of the whole plant.

¹⁵ John D. Black, *Introduction to Production Economics*, pp. 66-86.

¹⁶ Allan G. B. Fisher, *The Clash of Progress and Security*, pp. 25-32.

culture and for other industry are loose and not homogeneous, if judged by the logical consistency in theory. It is admissible because, in the first place, economics is a "human" science, and being a human science it has not yet reached the same degree of exactness as achieved by most of the pure or natural sciences. Moreover, as pointed in the Introduction, this essay is attempted, not only as a theoretical analysis, but also as an empirical and historical study. For empirical and historical studies, the "range of vagueness," or the "zone of indeterminateness," for conceptions and classifications is bound to be further enlarged. It is only by allowing a larger zone of indeterminateness that a contract of theoretical and empirical studies can be achieved.¹⁷ However, the question arises as to how to draw a line between the two zones. Answers to this question lead us to face a realistic situation in which gaps or overlaps between zones exist. Such a situation prevents us from achieving any theoretical perfection that, fundamentally, is based on the concept of "continuity" and "smoothness." To what extent should we sacrifice theoretical perfection in order to fit our analysis into the realistic situation is a question to which no satisfactory answer can be found at the present stage of economic study.

¹⁷ For many years I have been conceiving an idea that the best thing we can do in order to apply the method of scientific treatment used in "natural sciences" to "human sciences" is to replace the "point" concept by a "range" or "zone" concept. For example, in dealing with cost curves for a firm, or demand and supply curves for an industry, we can replace a "series of points" by a "belt" which may be called a series of zones.

The reasonableness and practicability of this compromise method was made greater when I found, during my stay in Harvard Business School, that many business firms have used the method of "practical zones" for making variable budgets for output and cost structure, and within the practical zone, no changes of adjustments are to be made. This practical zone is equivalent to our theoretical zone of indeterminateness, within which many points for possible adjustments exist and within which place where the optimum or equilibrium point should rest becomes indeterminate.

My view was once more strengthened when I later read a statement made by Schumpeter, in dealing with equilibrium and imperfect competition, that "the only thing we can do is to replace an 'equilibrium point' by an 'equilibrium zone,'" and another statement, in dealing with the usefulness of the equilibrium concept for the study of business fluctuations, that "since the system in practice never actually reaches such a state (which would, if reached, fulfill equilibrium conditions), we shall consider, instead of 'equilibrium points,' 'ranges' within which the system as a whole is more nearly in equilibrium than it is outside of them." See Joseph A. Schumpeter, *Business Cycles*, p. 58 and p. 71.

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